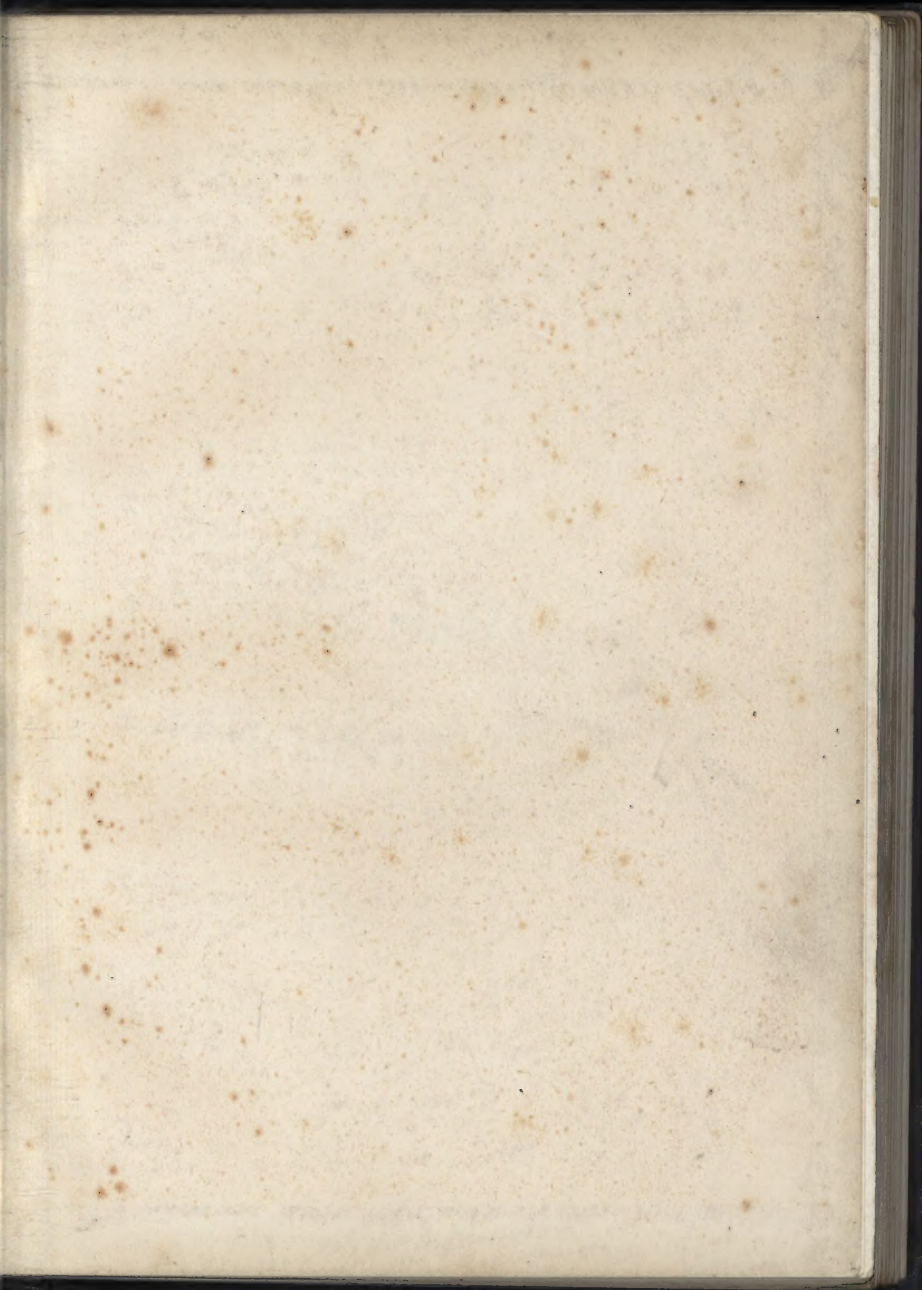


FRENA

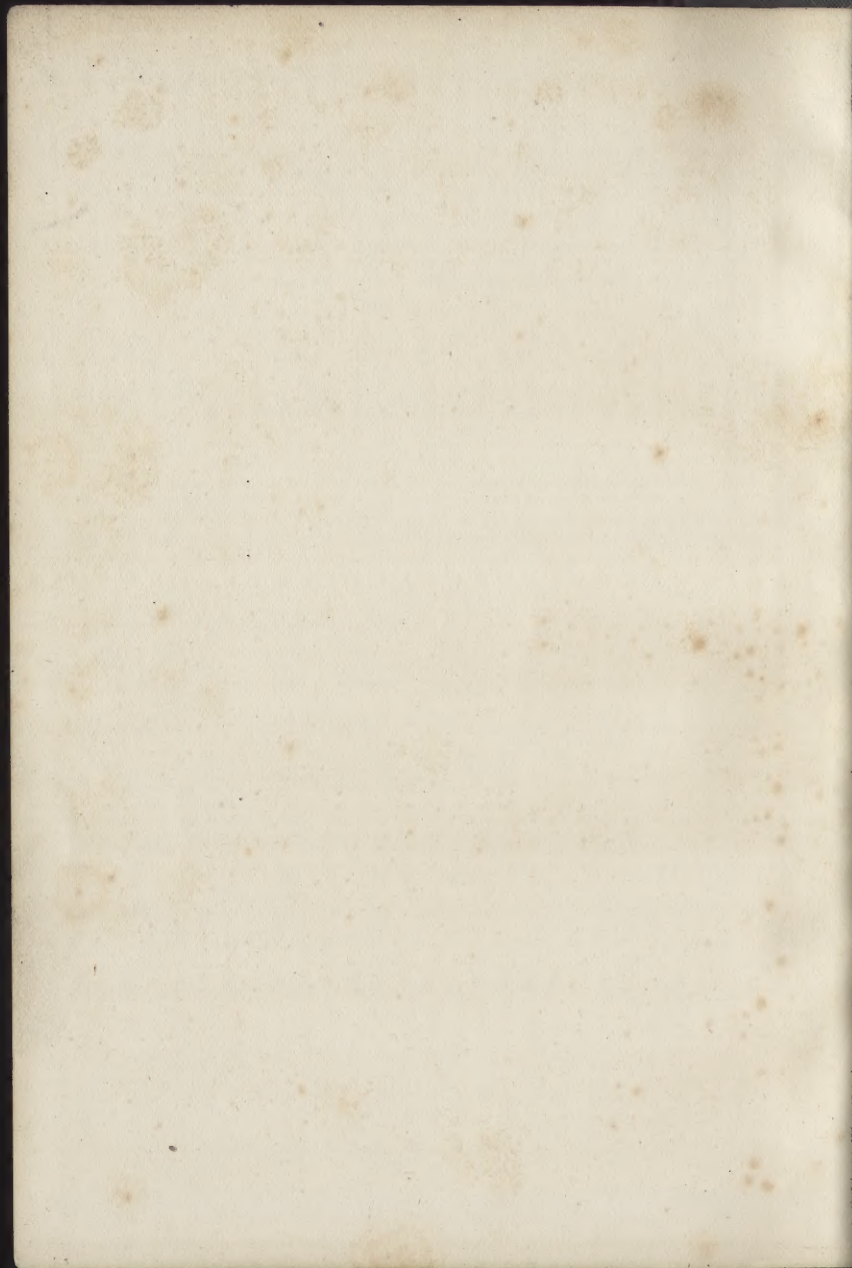
HANDBOOK.

Nº 2.

6







THE FRENA.



Eridani Phaethon periit male cautus in undis,  
Phœbei indocilis *frena* tenere jugi.  
Ipse hodie pueris Phœbus praesentior adstat  
Qui, medio laeti lumine, *Frena* regunt.

W. L.

*John Lubbock*

*From his very aff. father*

THE *John Lubbock*  
F R E N A *25 Oct 1899*  
HANDBOOK.

No. 2.

QUARTER PLATE SIZE.

BY  
THE INVENTOR.

LONDON:  
R. & J. BECK, LTD.  
68, CORNHILL, E.C.  
1898.

*My ingenious instrument !*

Cymbeline, iv. 2.



# Introduction.

---

HALF a century has now elapsed since the first steps were taken in the art of photography. Until recent years it was an art the practice of which was neither attractive nor readily acquired. The preparation of the plates necessarily devolved upon the operator, who, carrying his dark-room and chemicals about with him wherever he went, had not only to expose but to develop each negative while the glass was still dripping from the sensitizing bath. As the time of exposure was long, objects in motion could not be taken. So exceedingly complicated and tedious were the technical processes involved in finishing a picture, that the practice of out-door photography by an amateur was almost unheard of.

When, however, the so-called gelatine, or dry-plate process, superseded the collodion, or wet-plate process, the art was not only increased in capabilities, but was most widely extended. A new branch of manufacture has arisen, supplying us with plates and films ready for use, which retain their sensitive qualities for months and even years. Above all, we have now a photographic emulsion of a nature so sensitive that an instantaneous flash of sunlight suffices to give a perfect photographic image.

Delighted with the beauty and facility of modern photographic processes, a constantly increasing number of amateurs devote themselves to this pursuit. And with good reason, for no recreative study better repays its devotees.

Keeping pace with the demand thus created, there have been published a large number of manuals written for the purpose of instructing beginners in the art of photography. Among many others, we may refer the student to Burton, W. M., *Modern Photography*, London (Piper & Carter); Jones, Chapman, *Introduction to the Science and*

Practice of Photography, London (Iliffe & Son); Hepworth, T. C., Photography for Amateurs, London (Cassell & Co.); Abney, Captain W. de W., Instruction in Photography, London (Piper & Carter); by the same author, A Treatise on Photography, London (Longmans, Green & Co.); Brothers, A., Photography, its History, Processes, Apparatus and Materials, Philadelphia (Lippincott); Vieuille, G., Guide Pratique du Photographe Amateur, Paris (Gauthier-Villars); -Vidal L. Manuel du Touriste Photographe, Paris (Gauthier-Villars); Klary, C., Guide de l'Amateur Photographe, Paris (Marpon & Flammarion); Pizzighelli, Major G., Anleitung zur Photographie für Anfänger, Halle (Knapp); and by the same author, on a somewhat larger scale, in three volumes, Handbuch der Photographie für Amateure und Touristen, Halle (Knapp); Liesegang, E., Handbuch des praktischen Photographen, Düsseldorf (Liesegang); Schmidt, F., Compendium der praktischen Photographie, Karlsruhe (Nennich); Gioppi, L., La Fotografia secondo i processi moderni, Milano (Hoepli). The most complete works on the subject, in any language, are undoubtedly two books having the same title, viz., Ausführliches Handbuch der Photographie; the one by Dr. Eder, being published, in fourth edition, at Halle, 1890-91 (Knapp); the other by Dr. Vogel, being published, likewise in fourth edition, at Berlin, 1890-1891 (Oppenheim). Of these two rivals, we give our decided preference to the former.

From such books, as well as from the extensive periodical literature devoted to the subject, the student of Photography may gather full information concerning the principles of photographic optics, the reactions of photographic chemicals, the various and variable factors which govern the length of exposure, and, in particular, the means of producing the negative by development, and of reproducing it by the diverse methods of photographic printing. There is, however, one important topic, which is, unavoidably, treated but superficially in these works: they convey to the photographer little or no information directly applicable to the capabilities and the manipulation of the particular camera with which he may provide himself.

Our present purpose is to supply special information relative to the apparatus known as the *Frena*. Such a contribution to the literature of photographic manipulation is in this case the more necessary, as the *Frena* is the first hand camera to expose a pack of films in single sheets, like a pack of playing cards, without the intervention of double backs, roll-holders or carriers of any kind whatsoever.

In a general way it may be said that the following pages have been written with a view



of facilitating and improving the quality of amateur work by the methods of restriction and simplification. Freed from the perplexities which arise from a multiplicity of methods, the Frenographer will, we trust, make the most rapid possible progress towards technical excellence.

More than this. The adaptability of the Frena system is such that pictures of excellent quality may be taken by those who know nothing whatever about photographic processes, and have no desire to trouble themselves therewith. So simple, indeed, is the apparatus, that three manipulations, repeated for each exposure, are all that is actually required of the operator. These manipulations are :

1. **Wind the Shutter.**
2. **Make the exposure by setting off the Shutter.**
3. **Change the Film by turning the handle.**

*Anyone who can ring an electric bell and turn a key can take pictures with the apparatus which we place in his hands.*

When the forty photographs which form the first charge have been taken, the entire camera can, if desired, be sent to us unopened. We remove the photographic films, develop and print them, supply the pictures in any desired number, and return the apparatus recharged and ready for further exposures. This is photography in its simplest conceivable form.

If the operator be provided with a photographic dark-room lamp, he can, at night time, in any well-closed room, remove the exposed films from the receiving chamber of the Frena in the manner set forth in Section 12 of this book. He can then wrap the pack of exposed films in tissue paper, enclose them in the set of envelopes supplied for the purpose, and, after securely sealing the outer one, forward them to us by letter-post. By adopting this course, the Frenographer will not be deprived of the use of his camera at all. Full directions for packing and forwarding are given in Section 13.

Thus, *picture-taking* does not necessarily involve *picture-making*, and the practice of

this delightful and instructive art is possible for thousands who might otherwise have neither the time nor the patience to master its technical details.

We have a department devoted exclusively to the development and printing of Frena negatives. The most experienced and skilful operators are employed in this work. It is obviously our interest to obtain the best possible results from every negative entrusted to our care.

Let it be understood, however, that we strongly recommend every amateur to do his own developing. The interest and instructiveness of photography is in great measure dependent upon this practice, and a perfect knowledge in respect to the choice and illumination of the subjects, and the length of the exposure, can only be obtained when the operator carries out all the subsequent processes.

In conclusion, we would lay stress upon the fact that the Frena possesses features which enable it to be used for making pictures such as have, until the present date, been impossible with any form of hand camera; the swing back and level, for instance, which provide the only known means for taking photographs in correct perspective when the apparatus is pointed

slightly up or down, have hitherto only been found in the more bulky and expensive forms of tripod cameras.

In order that the operator may be enabled to take advantage of all the capabilities of the apparatus, we offer him herewith, together with a concise description of the necessary manipulations, an extensive series of Notes on the Use of the Frena, grouped under the following heads :—

	PAGE
<b>Outline of Operations .. ..</b>	<b>17</b>
<b>1. On the Choice of the View and its Composition in the Finders .. ..</b>	<b>33</b>
<b>2. On the Illumination of the Subject .. ..</b>	<b>47</b>
<b>3. On the Duration of the Ex- posure .. ..</b>	<b>51</b>
<b>4. On Winding and Setting the Shutter .. ..</b>	<b>64</b>
<b>5. On the Functions and Use of the Stops .. ..</b>	<b>70</b>
<b>6. On the Employment of Frena Magnifiers .. ..</b>	<b>79</b>



# THE FRENA.

13

PAGE

7. On the Use of the Swing Back and Level .. ..	84
8. On Holding the Frena, and making Hand Exposures ..	91
9. On Time Exposures and In- teriors .. .. .	98
10. On Changing the Film .. ..	106
11. On Reading and Setting the Indicator .. .. .	108
12. On Removing Exposed Films and Recharging .. ..	111
13. On Packing and Forwarding the Frena and Frena Films	134

## Appendix.

A. On the Development of Films with Rodinal .. .. .	137
B. On Development as a Criterion of Exposure .. .. .	153
C. On Printing with Chloride Paper .. .. .	158
Index .. .. .	171

The novice who desires to take pictures in the simplest possible way need read no more than the Outline of Operations, printed in red ink on pages 19 to 32. In his first attempts he need not avail himself of all the capabilities of the Frena. Thus he will not for instance, change the speed of the shutter, employ small stops, undertake time exposures, nor make use of the swing back.

On the other hand, let not the photographic operator of experience take umbrage at the axiomatic and apparently unnecessary character of certain passages in this little book. Incredible as it may appear to the expert, it is an everyday occurrence for beginners in hand camera work to attempt a long series of exposures with a cover-plate or felt plug obscuring the lens aperture,—or, worse still, to occasionally open the camera itself, in broad daylight, in order to ascertain that all is going on well inside. Therefore bear in mind, charitable expert, that what may be useless, if not actually offensive to you, may be a point of fundamental importance to your younger brother.

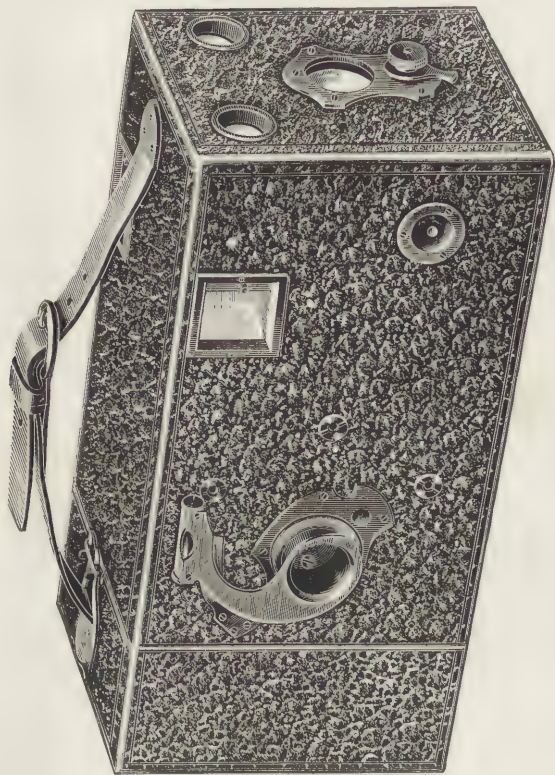


FIG. 1. THE FRENA (NO. 2) QUARTER PLATE.—ABOUT ONE-THIRD ACTUAL SIZE.

## ETYMOLOGICAL NOTE.

With a view to removing any uncertainty which may arise in the mind of some future philologist, it should be stated that the word **Frena** is derived from FARO (a game played with a box which holds a pack of cards, and, without being opened, automatically discharges one after the other), and from CRENA, *a notch* (the root of such words as Crenate, Crenel, &c.)

Should the etymologist object to this as an irregular and agglutinative derivation, he may be referred to the classical exemplification of Carrol's Law given in the preface to "*The Hunting of the Snark*":—

"For instance, take the two words 'Fuming' and 'Furious.' Make up your mind that you will say both words, but leave it unsettled which you will say first. Now open your mouth and speak. If your thoughts incline ever so little towards 'Fuming,' you will say 'Fuming-Furious;' if they turn, by even a hair's breadth, towards 'Furious,' you will say 'Furious-Fuming;' but if you have that rarest of gifts, a perfectly balanced mind, you will say 'Frumious.'"

We may hence safely conclude that if one possessed of this rarest of gifts should desire to convey to his fellow-man the conception of an apparatus which automatically discharges one film after another, like a *faro box*, and does this by means of *notches*, he would immediately exclaim "**Frena!**"



## The Prena.

### No. 2. Quarter Plate Size.

#### TECHNICAL DATA.

Model of lens...	...	"Autograph" Rapid Rectilinear.
Focal length of lens ...	...	$5\frac{1}{2}$ inches.
Normal Aperture of lens	F—11.	
Size of film ...	...	$3\frac{1}{4}$ inches by $4\frac{1}{4}$ inches.
Size of picture ...	...	3 inches by $4\frac{1}{4}$ inches.
Speed of shutter ...	...	$\frac{1}{80}$ to $\frac{1}{5}$ of a second ; also time exposures.
Weight filled with 40 films ...	...	4 lbs.
Dimensions of case ...	...	$11\frac{1}{4}$ in. $\times$ $5\frac{1}{2}$ in. $\times$ $4\frac{1}{2}$ in.

## Outline • of • Operations.

---

**No Camera in the world is more simple to use than the Frena.**

Hence let not the Frenographer stand aghast at the arid expanse of this little book. It is by no means necessary for him to read the whole of it before taking his first pictures.

All that the veriest beginner need master, at the outset, will be found in the fourteen following pages, printed in red ink.

The remainder of the volume amplifies these concise directions. In the pages printed in black will be found hints as to special manipulation, together with tabulated facts and technical data relating to the subject of hand camera photography in general and of the Frena in particular. We trust that these will prove of value to those Frenographers who become interested in the further capabilities of their apparatus.

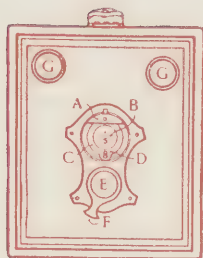


FIG. 2.—THE FRENA NO. 2.

*Front View.*

- A.—Lens Cover-plate.
- B.—Exposure Number.
- C.—Diaphragm Plate.
- D.—Stop Number.
- E.—Shutter Knob.
- F.—Stop Handle.
- G.—Finder Lenses.

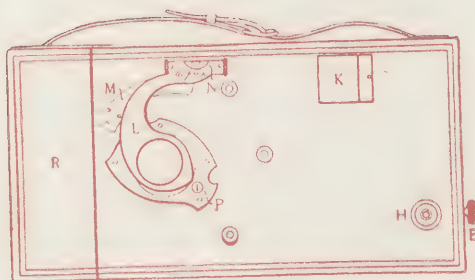


FIG. 3.—THE FRENA NO. 2.

*View of Right-hand Side.*

- E.—Shutter Knob.
- H.—Shutter Set-Off.
- K.—Horizontal Finder.
- L.—Handle.
- M.—Register Spring.
- N.—Level.
- P.—Indicator Hole.
- R.—Receiver.



## PRELIMINARY.

Cut the cord with which the Frena is sealed.

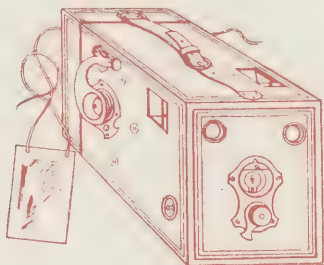


FIG. 4.

Before proceeding to take a picture, always make sure that the lens cover-plate is pushed up as far as it will go, so as to completely uncover the lens aperture.

OPERATIONS TO BE REPEATED FOR  
EACH EXPOSURE.

1.—**Wind the Shutter.** Compare page 64.

This is done by turning the milled knob which projects from the front of the case, just below the lens aperture, once around in the direction in which the hands of a clock advance.

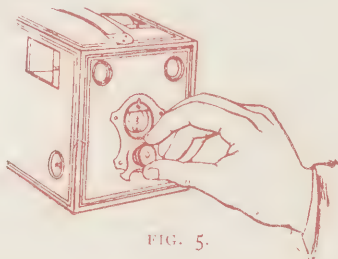


FIG. 5.

On the completion of one entire revolution a gentle click will be heard, after which the knob can be turned no further.

If the knob will not turn, the Shutter is already wound. In winding the shutter, be careful not to displace the Stop Handle.

*For instructions relative to Changing the Speed of the Shutter, see page 66.*

2. **Point the Frena to the object which is to be photographed. Page 33.**



FIG. 6.

Inspect the image in the Finder.

Determine whether the view is best adapted to a vertical or horizontal picture.

**3.—Set off the Shutter. Page 91.**

This is done by pressing in the bolt which projects from the right-hand side of the Frena near the lower front corner.

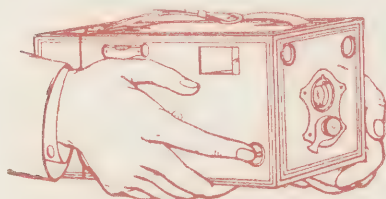


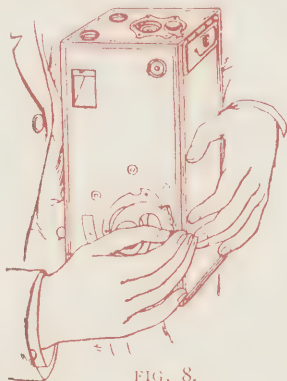
FIG. 7.

*Hold the Camera steady.*

*Press the Set-off gently. Do not jerk.*

**4.—Change the Film. Page 106.**

Hold the Frena with the Lens pointing directly upwards. Release the Register Spring (M, Fig. 3), which locks the handle.



Turn the Handle backwards and downwards (*i.e.*, in a direction contrary to that in which the hands of a clock move), as far as it will go. This will be found to be somewhat more than one half a revolution.

Make sure that the handle goes as far as it is intended to: so as to tap audibly against the internal stop which sets a limit to its travel. Do not jerk the handle back again as soon as this stop is reached; rather allow it to rest at the end of its journey for a fraction of a second.

*Turn the handle steadily, and not too rapidly.*

Turn the handle back to its normal position, permitting it to catch in the register spring.

Continue to hold the Frena with its lens pointing directly upwards until these operations are completed.

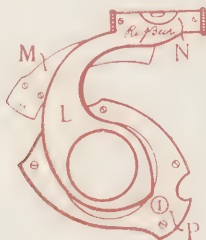


FIG. 9.

- 5.—Note the indicator reading shown by the numeral which appears in the inspection hole P. Fig. 9.

*N.B.—Acquire the habit of Changing the Film before Winding the Shutter. If this is done, two exposures will never be found upon one and the same film.*



**TO REMOVE EXPOSED FILMS.****Page 113.**

Take the Frena into a photographic dark room.

Unbuckle the strap-handle. Undo the spring-catch on the top of the case. Remove the Receiver from the back of the case.

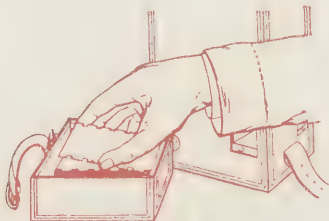


FIG. 10.

The exposed films, together with their backing cards, will be found in the Receiver. Extract them by grasping the edges. Do not touch the sensitive surfaces with moist fingers.

## TO RECHARGE WITH FRESH FILMS.

**Page 126.**

In a photographic dark room, remove the Receiver of the Frena, as above directed. Stand the camera upon its lens end.

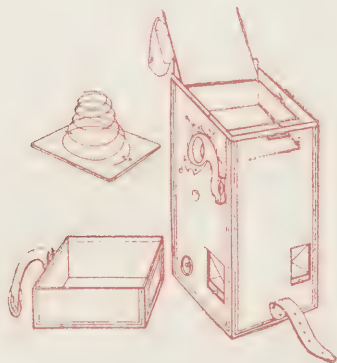


FIG. 11.

Undo the catch of the Film-holder, and fold back the hinged flap. Take out the pressure board, lifting it by the spiral spring.

If the holder be entirely empty, place in it a Dummy Film.

As is shown in Fig. 12, the Dummy Film (which is identical in outline with the other films), has two corners, N,N, which are notched.

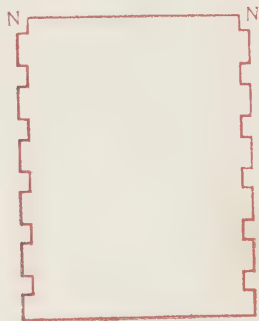


FIG. 12.—QUARTER PLATE DUMMY FILM.

*Actual size,  $3\frac{1}{4}$  by  $4\frac{1}{4}$  inches.*

Observe the reading of the Indicator. If it displays an *odd* number, place the Dummy Film in the holder with its notched corners *up*, i.e., towards the top or strap-handled side of the camera. If it displays an *even* number, place the Dummy Film in the holder

with its notched corners *down*, *i.e.*, towards the bottom of the camera.

ODD = UP  
&       &  
EVEN = DOWN

The Dummy Film is made of cardboard so stiff that it is not liable to be bent and displaced by the pressure of the hand.

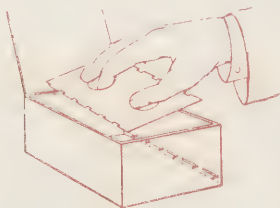


FIG. 13.

The Dummy Film may be conveniently grasped by inserting the thumb and forefinger in the two round holes cut therein. It must then be so laid into the holder that the notched sides rest evenly upon the pointers.

It is not necessary to make use of a Dummy Film if any films remain unexposed in the holder. If the Dummy Film be inserted, it must be discharged by turning the handle once around before proceeding to take the picture. In reading the indicator, account should be taken of this change.

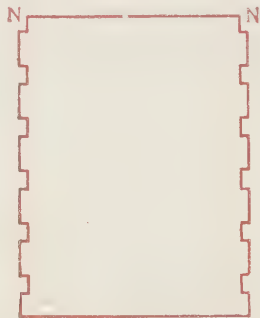


FIG. 14.—QUARTER PLATE FRENA FILM.

*Actual size,  $3\frac{1}{4}$  by  $4\frac{1}{4}$  inches.*

On top of the Dummy Film, place a photographic film, together with its backing of opaque paper. This film must be placed in the holder with its sensitive surface downwards, *i.e.*, towards the lens, and with its

notched corners in the opposite direction, as regards top and bottom, to those of the Dummy Film which has preceded it.

Proceed to fill the holder with the Films in alternating sequence as regards the position of their notched corners, that is to say, in the same arrangement as they are packed and supplied by the manufacturers.

The total number of films introduced into the holder should not exceed forty (or two packs) in all.

Replace the pressure board. Close the hinge-flap, securing it by the catch. Attach the Receiver, fastening it by the snap catch on the top of the case. Buckle the strap handle.

The Frena is then ready to take more good pictures.



## Section 1.

---

### ON THE CHOICE OF THE VIEW AND ITS COMPOSITION IN THE FINDERS.

ON the top of the Frena, in a square sinking near the left hand front corner, and on the

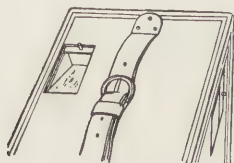


FIG 15.

right hand side, in the same relative position, are the *View Finders*, Fig. 15: the former for upright, the latter for horizontal pictures.

Each of these Finders show, by means of a secondary lens, a ground glass screen, and a reflector, the same image as that cast by the chief lens upon the sensitized surface within the camera. The image shown by the finders is, of course, on a smaller scale, and reversed as regards right and left, but it is the right way up, and distinctly displays all the features which are included within the field of view.

The grouping of the picture which is to be taken may thus be done within these frames. Nothing is simpler. The photographer can, by changing his standpoint, and by altering the direction in which the Frena is pointed, compose the picture upon the ground glass as the artist composes his painting. When it is found that the whole of the subject desired is not included in the finder, the camera must be moved further away. If the image is too small, or if undesirable features occur at the sides of the picture, the camera must be moved nearer to the chief object in the scene. After a little practice the operator will acquire an almost instinctive knowledge of what will be included within

the angle of his lens, and will judge pretty accurately at what distance from the chosen subject to place the camera.

In the first place, a word of general warning. The beginner should be on his guard against a constant temptation which will be felt to expose the films upon all manner of inartistic and uninteresting subjects. It is unsportsmanlike to waste powder and shot for the mere sake of shooting. See to it that every negative is either a picture or a record. In the case of subjects which are not of a transitory nature, take due time for consideration, attentively observing the landscape in order to ascertain whether it will not be better lighted at some other hour. See whether shifting the point of view, a short distance to the right or left, backward or forward, will not improve the grouping. The finders are view meters always at hand for such use.

It is, of course, to be borne in mind that the view shown in the finder is upon a smaller scale than that thrown upon the sensitive surface within the camera. The novice should be on his guard against errors of

judgment in this regard. Large and awkwardly situated objects appear much more prominent upon the finished photograph. On the other hand, objects which are very small, or which are situated at a great distance,—such, for instance, as a boat on the horizon at sea,—will often be as imperceptible upon the finished picture as they are in the finder.

The first point to be settled is, whether the picture is to be vertical or horizontal, and, in consequence, whether the finder on the top of the camera, or that upon its side, is to be employed. This is one of the fundamentals of artistic composition, and at first sight would appear to admit of but one solution for each class of subject. But experience shows that this is by no means the case. We are daily astonished, on the one hand by the novel and admirable effects which skilful photographers obtain by unexpectedly arranging a broad landscape in an upright frame, or an upright figure in a horizontal frame,—and on the other hand by the thoughtless blunders which beginners are wont to make by interchanges in this regard. It is of no avail to lay down rules as to the adaptability of such and such

views for upright or horizontal pictures. All that can be said is, that the chosen objects will usually be best represented on the largest scale and to the fullest extent compatible with an entire freedom from any crowding or cramping of the picture. Thus a long horizon in an open landscape or sea view will, in the majority of instances, be best fitted to a horizontal picture, and a doorway or single erect figure to an upright picture.

It should be borne in mind that in the Frena No. 2, the customary proportion of the actual picture of quarter plate size, namely, 12 to 16, is increased to 12 to 17, thus giving considerably greater scope in the longer dimension: that which from artistic considerations it is most desirable to extend. The fact that a more elongated frame than one having the proportion of 3 to 4 is desirable for the generality of artistic representations will become evident on examining the proportions of the frames in which the best painters of all ages and all schools have decided to compose their designs.

One of the most common defects in the composition of hand camera pictures is the appearance in the view of an extended and

vacant foreground. There should generally be, if possible, some object of interest not more than ten or fifteen yards distant from the camera.

In photographic prints, even more than in nature, objects are rendered prominent in proportion to the lightness of their colour, and nothing is more intolerably bare and unattractive than the broad white expanse of an unpeopled road or public square, such as often forms, as a foreground, the larger part of hand camera pictures.

One of the great difficulties in taking pictures with any hand camera is getting it high enough during exposure. In the case of most landscapes or figure subjects a picture, to look natural, should be taken with the lens at about the height of the human eye. Now, as the easiest way of holding a hand camera during exposure is to place it beneath the arm, or to hold it against the breast, so that the image in the view finder can be conveniently examined, it results that the photographs of landscapes and street views are commonly taken from a level which is about half a yard too low. It is,



however, often possible to obtain a higher point of view by standing upon some slight eminence, and, as the extent and interest of the foreground are thus increased, this is to be recommended.

Professor Burton has truly remarked: "There is one kind of work in which we are inclined to think a lower point of view than that of the eye when standing is seldom admissible. We refer to street scenes. We do not sit down in the street to look either up or down it . . . Nor does a man carry his head under his arm, or have his eyes in his stomach. On the other hand, a high point of view is not by any means uncommon. We constantly have it from the top of a vehicle, or out of a window." But when this author contends that "the camera should be held rather above than below the level of the head," he makes a demand with which few operators are able to comply. This is an awkward and conspicuous posture, and greatly increases the difficulty of holding the camera steady. It is obvious that it could only be employed for the very shortest exposures, and that the camera, if held above the head, would have to be upside down in order that the view finders might be visible.

On the other hand, pictures of small children, or of dogs, sheep, &c., are best taken from a point of view not higher than half or

three-quarters of a yard above the ground. To secure this the Frenographer may kneel, or sit, and support his camera upon one knee.

For convenience in estimating the relative sizes in which figures will appear in the finished picture, the photographer who works with the Quarter-plate Frena may bear in mind that the image of a full-grown man at a distance of five yards from the camera, will be about two inches high upon the film; at a distance of ten yards, one inch high; and at a distance of twenty yards (or about the width of the larger London thoroughfares), half-an-inch high.

Subjects moving at right angles to the line of vision require, as may be easily demonstrated, a much more rapid exposure than do subjects whose movement more nearly approaches the direction of the line of vision. For instance, a photograph of an express train at full speed, taken broadside on, at a distance of 60 yards, with a lens whose focal length is equal to that of Frena No. 2, would require, in order to give a fairly sharp image, an exposure not longer than one two-hundredth of a second. In the case of a dark subject like this, so short an exposure

would, in fact, not suffice to admit the light requisite for the production of a chemical image upon the sensitive surface of the film. But by choosing a position in which the angle formed by the direction of the train to the line of vision is not greater than about forty degrees, it would be found possible at the same distance to obtain an equally sharp picture with the practicable exposure of one-eighth of a second.

In taking pictures of galloping horses, rapidly sailing yachts, racing cyclists, runners, &c., due attention should be paid to this consideration. By devoting a little thought to the choice of a favourable point of view, good pictures of objects in rapid motion may often be secured which would otherwise be found unattainable.

Let the subjects selected by the beginner for his first attempts be street scenes and landscapes, rather than portraits and groups. It is, we fear, to the inevitable failures in work of the latter class that we must ascribe the common belief that photographs made by amateurs are necessarily inferior to those made by professional photographers. This

discouraging prejudice is untrue. Without doubt, the beginner, especially if entangled in a multiplicity of manipulations and processes, will, at the outset, almost always produce inferior work. And, without doubt, portraits taken by amateurs will in certain technical qualities always remain inferior to the results obtained in a well-equipped studio, with broad skylights and skilfully arranged screens, where each process is entrusted to a specialist who can make a life-long study of the particular branch to which he devotes his attention. Yet even in the portrait the works of a thoughtful amateur are not infrequently superior in the high qualities of truthful rendering of character and personal interest: taking, as he does, his subjects in their every-day garb and postures, and keeping his work free from that debasing smoothness and fashion-plate grace which is the inevitable result of thorough retouching.

It is, however, in the landscape that the amateur will meet with his earliest successes. Here opportunity is everything. Provided with a ready and so to speak infallible means

of perpetuating the scenes through which he passes, his pictures, if selected with care and intelligence, may compete on equal terms with the best work of the professional photographer.

It is, in general, ill-advised to attempt to photograph a wooded landscape when the sun is not shining. Much of the vigour and relief of the picture is due to the high lights and the shadows of sunlight. Above all, windy days, however bright, should be avoided in photographing foliage. The movement of the leaves and branches is sufficient to blur the outlines, except in the case of very short exposures.

Let it be furthermore borne in mind that the monochromatic translation of a mass of gorgeous colouring will, in many cases, not make a satisfactory picture.

It is a well-known fact that photographs cannot, without the aid of orthochromatic plates, stained screens and long exposures, render the true tint value of the colours of the spectrum: yellow and red appearing

too dark, violet and blue too light. Thus, delicate white clouds will be altogether indistinguishable from the blue sky in which they float, while a hedge or copse of summer foliage on the horizon, which is in nature of the richest green, will appear in the photograph as a solid black band, cutting off the earth from the heavens.

For similar reasons the position of the sky-line in the picture is a matter of even greater moment to the photographer than it is to the painter. It is usually recommended by the text books that the horizon should be one-third or two-fifths from the bottom edge of the print, but such a rule leaves out of account the height from which the view is seen. If the picture be taken from an elevation, with a wide expanse of landscape which must be shown somewhat as a bird's-eye view, the horizon may approach much more nearly to the top of the print. Rules are of little avail in matters of this kind. It can, however, be safely said that a straight sky-line, especially when exactly in the middle of the picture, does not look well.



After some little experience, the operator will be able, in selecting his pictures, to see the colours of this world as the photograph will represent them. As an aid to obtaining this photographic vision, the beginner may wear a pair of dark blue spectacles, or look at the landscape through a small square of cobalt blue glass. A glass of this colour will show the view practically in monochrome. Seen through it, foliage in the foreground will appear unduly dark in comparison with the distant landscape, precisely as it will come out in the finished photograph.

But this is by no means all. A large measure of individual thought and care is always requisite for the making of a good picture. It is true that no pursuit is better adapted than photography to cultivate the powers of observation, but this cultivation is not to be acquired without attention and reflection.

The wide capabilities and simple manipulation of the Frena offer the greatest possible aid in technical respects to the beginner in photography. But there can never be a short cut to the acquirement of artistic treatment.

The subjects capable of being depicted by photography are so multifarious, and the aspects, even of any one subject, so diverse, that those æsthetic rules

which we find laid down in little books on picture-making must be considered as worse than useless. Such formulæ can never take the place of individual taste, and attempts to adhere to them result too often in a deplorably mechanical arrangement of line and chiaroscuro. Nevertheless, this matter of artistic composition is one which, though it cannot be encompassed by arbitrary formulæ, yet deserves the most constant and thoughtful attention. Given a subject of interest, the artistic qualities which the photographer should endeavour to obtain in its rendering are, above all, simplicity, breadth, and impressiveness. He will, in this endeavour, derive less assistance from the maxims of text books than from an attentive observation of the works of great artists. Let him examine analytically the composition of pictures of all kinds which he feels to be significant and pleasing. He must not expect to abstract any set of laws through such study, but he may hope that his appreciation and instinct for excellence of arrangement may thereby be increased. It is one of the inestimable benefits of the practice of photography that the eyes of the operator are opened to innumerable phases of life and art which he had before left unregarded.

## Section 2.

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### ON THE ILLUMINATION OF THE SUBJECT.

FOR the taking of instantaneous photographs the one condition of paramount importance is a good light.

**That beginner adopts a safe and advisable course who takes pictures only when the sun is shining.**

However protracted the exposure, photographs taken on dull or foggy days, or in the dull yellow light of morning and evening, will almost always be found flat and wanting in contrast.

In Great Britain the light, in clear and bright weather, may be sufficiently powerful

to permit of very rapid, or so-called instantaneous, exposures during the following hours :—

June .. .. .	V a.m. to VII p.m.
July and May ..	VI „ VI „
April and August ..	VIII „ V „
March, September and	
October .. ..	IX „ III „
January, February, Novem-	
ber and December ..	XI „ I „

In more brilliant light, such, for instance, as that of Southern Europe, successful instantaneous views can be obtained within wider limits.

In the determination of the point of view from which the illumination is most satisfactory, much will depend upon the taste of the photographer.

**It can only be stated, as a general rule, that good results are most easily obtained when the sun is shining directly upon the subject, over the operator's shoulder.**

If the sun is exactly behind the operator, the illumination will often be found too flat, and the shadows too symmetrical and

monotonous to throw the object into vigorous relief. If, on the other hand, the sun is directly in front of the object, there will be little else in the picture than a dark silhouette against the sky, and it will be found that, in a photograph of such shadows, the details are much less readily to be distinguished than they are in nature by the human eye.

**On no account should the Frena be so held that the sun shines into the lens aperture during exposure.**

A totally fogged plate would be the result.

When the sun is shining brightly and there are white clouds in the sky, the illumination in the shadows will be better, under otherwise similar conditions, than when the sky is entirely without clouds. One of the most noticeable shortcomings of hand camera work is the lack of detail in the shadows. Snap-shot pictures, taken on very bright and cloudless days are not unfrequently chalky white in the lights and inky black in the shadows. The fact is that the brighter the sun, and the shorter the exposure in consequence, the more this defect becomes apparent. Objects in the shade are, of course, illuminated solely by reflected light, and when the earth is carpeted with a dark verdure, as is the case in most summer landscapes, the shadows receive but little light other than that reflected from the sky. Bright white clouds on

a summer day thus take the place of the reflecting screens in a portrait photographer's studio. And hence we have the paradox that the most cloudless day is not always the best for instantaneous photography.

One other point relative to the actinic quality of light requires far more attention than is apparent at first thought. This is the reading of the hygrometer, or in other words, the relative amount of aqueous vapour in the atmosphere. Such vapour reflects a large amount of actinic light, often sufficient to render the features of a distant landscape, which can be perfectly seen by the eye, altogether indistinguishable on the photographic plate. A haze, invisible to the eye in nature, will, on sunny yet slightly damp days, hang like a veil over the background of photographic landscapes. In England the air is seldom so free from moisture that objects some miles off can be photographed with entire distinctness. This is the cause, often overlooked, of a defect common in photographs of English scenery. From humid Harrow Hill, for instance, both the Crystal Palace and Windsor Castle can frequently be seen. No photograph could possibly show them. In the perfectly clear and dry atmosphere of Colorado, on the other hand, every detail can be traced in the images of mountains more than thirty miles away. It follows that for views of distant landscapes days should be selected when the air is comparatively free from haze. The same view taken before and after a thunderstorm will show a surprising difference in this respect.

## Section 3.

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### ON THE DURATION OF THE EXPOSURE.

IN illustration of the wide range of photographic exposures under various conditions of light, we cannot do better than quote the words of a well-known authority :

“On one occasion I was asked to photograph the interior and exterior of a large house. One of the interior views was a magnificent hall, with dark panelling, relieved by armour, the whole being bathed in a very subdued light. With a very rapid plate, I gave my picture an exposure of two-and-a-half hours. I then went outside the house, and took a view of the exterior, using the same stop and description of plate. The exposure was now just two seconds. Both turned out to be first-class negatives.” (Hepworth, “Photography,” p. 42.)

This is undoubtedly an extreme case, but it is not at all an incredible one. The Frena amply provides for such variability of exposure, having a shutter with which (as set forth in the following section of this book)



the rapid exposures may readily and with certainty be altered from one-eightieth to one-fifth of a second, while there is no limit in time to the longer exposures made by hand.

The means of adjustment being thus at hand, the great question arises: What is the correct length of exposure, or, in other words, to what speed must the shutter be set for any given view? This is without doubt the most difficult problem with which photographers, whether amateur or professional, have to deal. It is one which cannot be adequately met by any empirical rule, and, even after the fundamental principles have been clearly understood, it will always require careful attention in each particular case.

Nevertheless, for those who have neither time or patience to enter into a scientific consideration of the matter, a rule-of-thumb table may be given as follows:—

**Exposures for Frena No. 2, with normal aperture (F. 11=U.S. 8.) when the sun is shining brightly, within 2 hours of noon, in May, June and July.**

MARINE VIEWS—  
*1/80th second.*

## STREET SCENES—

*Fully lighted by sun,  $1/40$ th— $1/20$ th second.*

## LANDSCAPES—

*No foliage or other dark objects in foreground,  $1/20$ th second; with foliage in foreground,  $1/10$ th— $1/5$ th second.*

## PORTRAITS—

*Out of doors, not in direct sun, yet brilliantly lighted,  $1/5$ th second; in ordinary well-lighted rooms, within ten feet of window, 4 seconds.*

## INTERIORS—See p. 103.

*With light hangings and several windows, try 20 seconds; with dark hanging and one window, try 10 minutes.*

For noon-day sunlight in March, April, August and September, one-half should be added to the above exposures. For February and October they should be doubled; for the three winter months, quadrupled.

It must be distinctly understood that the only value of such a table lies in the fact that it gives an approximate idea of the relative exposures necessary.

Those who desire to cultivate an independent judgment in respect to this matter of exposure, should devote careful consideration to the following points, and should repeatedly read the chapters upon the subject which will be found in the photographic handbooks cited in the introduction.

Three chief factors enter into the determination of the duration of all photographic exposures.

**I. Sufficient light must have access to the film to produce upon the sensitive surface an image capable of development, otherwise the negative will be underexposed.**

**II. The object photographed must not have time to move perceptibly during exposure, otherwise the image of this object will be blurred.**

**III. The camera must not be moved during exposure, otherwise the picture will be blurred all over.**

Now as to the first and most important of these factors.

## I.—THE LIGHT.

Sufficient light must fall upon the sensitive surface to form upon it a chemical image, capable of subsequent development. We may put this fact in other words, by saying that the lens aperture must be opened for a longer or a shorter period, in accordance with the amount of light reflected from the object which is to be photographed. Having, as definitely determinable data for our computation, the lens aperture Frena No. 2 (F. 11), and the average rapidity of the Frena Films, as supplied by the various makers, (W.S. 28), it may readily be ascertained that a perfect photographic image of the sky, the open sea, or the similarly reflecting waters of a river, might be had, on a bright summer's noonday, with an exposure not longer than, say, one thousandth of a second. But let there be introduced into a picture taken under identical conditions in respect to the illuminating power of the sun, any object of a darker colour, or, in other words, any object reflecting less light, such as brick buildings against the sky, a conspicuous vessel upon the sea, or a mass of foliage upon the river's bank, and these objects will be found represented upon the negative by an absolutely blank patch, appearing in the print as a black silhouette.

It is obvious that the first step towards a scientific determination of the requisite length of exposure is to ascertain the comparative actinic effect of the different colours. This may best be done by ex-

aming a photograph of the solar spectrum, and by comparing it with the visual intensity of the many-coloured band itself.

It will at once be apparent that the most vigorous photographic effect is produced by the violets and blues, the least by the yellows and reds. Between these two extremes of the spectrum the intermediate colours stand in a regular progression. Thus, green, which is about midway, will give a photographic image of greater or less intensity according as its tint tends towards the brilliant bluish green of early spring, or the yellowish hue of falling autumn leaves. It is obvious, likewise, that in the case of every colour, the depth of shade, whether light or dark, will be of direct influence in determining the photographic value.

A further step is the determination of the power of the sunlight itself, or in other words, the photographic intensity of the illumination at the time when the photograph is taken. Owing to two chief reasons, this is a matter of extreme difficulty.

In the first place, the human eye, by the contraction and dilation of the pupil, involuntarily adapts itself, within certain limits, in accordance with the varying intensity of light. This greatly affects the subjective impression which is received at different times from lights of different degrees of intensity. It is altogether exceptional that two or more lights whose photographic values are to be estimated are simultaneously in view, and can be directly compared.

In the second place, the standard of illumination for the human eye is by no means identical with that of the photographic plate. The chemical effect upon the silver salt is produced chiefly from the violet end of the spectrum, while the compound white light which affects the eye contains a far greater proportion of red and yellow rays. Hence, a new and, to preconceived ideas, unnatural standard of actinic efficiency has to be continually applied in judging the photographic value of the sunlight itself. It has been estimated that nearly one-half of the solar light which is effective in impressing the chemical image upon the photographic plate, consists of ultra-violet rays, which are not perceived by the human eye at all. Even the violet and blue rays of the spectrum, which form the greater part of the remaining half, have but a comparatively small visible effect. Now the light of the sun, in passing through the atmosphere which surrounds the earth, is shorn of a certain proportion of its ultra-violet and blue rays, and this deprivation is, of course, the more marked the more obtuse the angle at which the rays reach the earth, and, in consequence, the more extended the stratum of atmosphere which the sunlight has to traverse. Thus it comes about that the well-known reddish tinge of sunrise and sunset light is a phenomenon which produces far less appreciable effects upon the photographic plate than upon the human eye.

Hence also the surprisingly short duration of the exposures which are found sufficient in the tropics,

where the rays of the sun are more nearly vertical, and contain a larger proportion of ultra-violet and blue. Professor Roscoe has estimated the actinic efficiency of the unclouded noonday sky, at the time of the equinox, to be in Egypt more than double that of Southern England; and in Iceland, at the same season and under the same conditions, to be less than half that of Southern England.

In similar manner the presence of a scarcely perceptible ruddy haze in the atmosphere—as for instance that caused by the smoke of a large city—will have to be taken into due consideration. All murky skies introduce into the calculation of the illuminating power of the sun an extraordinary depression of the actinic value, and necessitate a corresponding increase of the photographic exposure. Under such conditions the exposure of the photographic plate will have to be prolonged far more than might at first be supposed, and in extreme cases the resulting negative, even with the most skilful treatment, cannot fail to display a certain want of definition and of due balance of light and shade. With the exception of cloud subjects and sea views, the photographer will find little satisfaction in work done in dull or ruddy light.

## II.—MOVEMENT OF THE OBJECT.

Theoretically speaking, it is a matter of impossibility to obtain an absolutely sharp image of any object in motion, inasmuch as the duration of the exposure would require to be infinitely small. In practice, however, it will be found that the image of any point



upon the negative will appear sharp, provided it be not displaced in its plane, during the act of exposure, to a greater distance than  $1/100$  of an inch. Even  $1/50$  of an inch displacement will still give a fairly good picture. Bearing this fact in mind,—and having as data the focal length of the lens in the Frena No. 2 ( $5\frac{1}{2}$  inches), the distance of the camera from the moving object, and the rapidity of the movement of the object itself,—it is easy to calculate the maximum length of the photographic exposure which may be made if the sharpness of the definition is to come within the above limits. Supposing, for instance, that we wish to take the picture of a man walking rapidly at right angles to our line of vision on the opposite side of a street of ordinary width, say at a distance of 12 yards. The focal length of the lens in Frena No. 2 being about  $5\frac{1}{2}$  inches, it follows that a movement of 1 inch on the part of the pedestrian will blur the outlines upon the plate by about  $1/100$  of an inch. Supposing, furthermore, this pedestrian to be advancing at the rate of 4 feet a second we may feel safe in giving to our picture an exposure of  $1/40$  of a second. If our man on the other side of the street be not directly opposite us, but be moving towards or from us at an angle of say  $45^\circ$ , it is obvious that we can double our exposure without decreasing the sharpness of the image. Looking at the matter in this way we may, for the Frena No. 2, compute the following table of exposures possible in the case of bodies moving at right angles to the line of vision :—

Express Train.	90	..	..	..	1/80
Freight Train.	40	..	..	1/80	1/40
Steam-boat.	20	..	1/80	1/40	1/20
Horse Galloping.	36	..	..	1/80	1/40
Horse Trotting	18	..	1/80	1/40	1/20
Carriage at Ordinary Speed.	10	1/80	1/40	1/20	1/10
Horse Walking.	5	1/40	1/20	1/10	..
Man Running.	7	1/80	1/40	1/20	1/10
Man Walking.	4	1/40	1/20	1/10	..
Approximate Movement in feet per second.					
At 12 yards					
At 30 yards					
At 60 yards					
At 120 yards					

When the movement of the body is at  $45^{\circ}$ , or thereabouts, to the line of vision, these exposures may be doubled; when at  $30^{\circ}$ , they may be quadrupled, and yet maintain the same degree of sharpness. This fact has already been noticed in the section dealing with the choice of the view.

In regard to other subjects, the rapidity of whose movements is not so readily estimated, we shall not be far wrong in making exposures within the following limits:—

The smile of children, or other fleeting expressions of the human countenance, in taking which we may wait for a favourable instant,  $1/5$  to  $1/2$  of a second.

The ordinary movements or postures of domestic animals, such as the evolutions of a trained dog, &c.,  $1/10$  to  $1/5$  of a second.

Grazing cattle,  $1/10$  to  $1/2$  of a second.

Ordinary street scenes with many figures, taken from a window, or from the top of an omnibus, with no figures nearer than about 15 feet,  $1/40$  to  $1/20$  of a second.

Sailing vessels not nearer than 100 yards,  $1/20$  to  $1/10$  of a second.

Steamers at 100 yards, and sailing vessels at nearer distances,  $1/40$  to  $1/20$  of a second.

Wild animals of large size, such as caged beasts in Zoological Gardens,  $1/80$  to  $1/20$  of a second.

Running and trotting horses, flying birds, runners in races, cyclists, &c.,  $1/80$  of a second.

The limit of rapid exposure actually admissible in such cases is, of course, determined primarily by the illumination and the colour of the subjects, in accordance with the considerations set forth under the preceding heading. When the light reflected from a body is not sufficiently powerful to allow of exposures as short as one fortieth of a second, pictures of running horses, railroad trains, and the like, should not be attempted at all.

### III.—MOVEMENT OF THE CAMERA.

This third factor needs but few words of comment. It is clear that if, during the act of exposure, the camera be moved in such wise that the image of any fixed point is displaced, laterally or vertically, upon the sensitive surface of the film, by more than one-hundredth of an inch, the picture will be blurred. Any movement of the camera in a direct line, towards or from the object photographed, is never sufficient to require taking into such account.

The amount of movement in the plane of the film which is liable to occur during an exposure of any given length is largely a matter of personal equation. Even the most nervous and jerky beginner will seldom fail to obtain a sharp negative with an exposure as short as  $1/40$  of a second. Starting from this lower limit we find individual ability to hold a hand camera motionless to vary greatly. There are some practiced photographers of steady nerve who can obtain per-

fectly sharp pictures with an exposure as long as an entire second ; but this is exceptional. As a general rule it may be said that if the camera is held in the hands, and the body is not in any wise steadied, it will not be found practicable to give a longer exposure than  $1/10$  of a second.

Advice concerning the means of steadying the body, holding the camera against the hip or chest, and refraining from drawing breath during the act of exposure, will be given in Section 8.

The actual movement of the camera is, of course, directly affected in all cases where the photographer does not stand on firm ground.

Pictures taken from a vehicle in rapid motion, even with so short an exposure as  $1/80$  of a second, will always show more or less blur in the foreground. Pictures taken from a railroad train in motion, with the same exposure, will give a fairly distinct image only in the case of objects which are 150 yards, or more, distant.

Moreover we have, apart from the actual speed of any conveyance, to deal with the question of jarring and jolting movements. The vibration of machinery, as for instance the engines of a factory, or of a steamboat in motion, often render it altogether impossible to obtain a sharp image. Influences of this class vary so greatly in respect to the rapidity and frequency of the shake which they convey to the camera that no fixed rules can be given. The photographer will, however, soon acquire an almost instinctive judgment as to the possibilities of steady exposure.

## Section 4.

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### WINDING THE SHUTTER.

Projecting from the front of the camera, immediately beneath the lens aperture, is a knob with milled head E, Fig, 17.

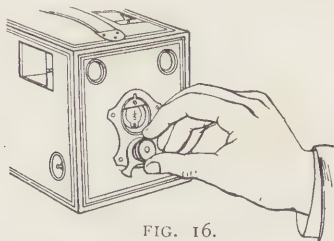


FIG. 16.

**In order to wind the Shutter, this knob must be turned around one complete revolution, in the direction in which the hands of a clock move.**

This operation is illustrated in Figure 16. The winding will be most easily performed by taking firm hold of the milled head and *rolling* it, as it were, between the thumb and forefinger of the right hand. On the completion of an entire revolution a gentle click will be detected, after which the knob can be turned no farther.

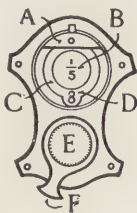


FIG. 17.

If the knob be released after having been turned but a part of its revolution, so that the beforementioned click is not detected, an imperfect exposure may result.

**When the Shutter is completely wound the exposure number (B. Fig. 17) should be seen in the middle of the lens aperture.**



The Shutter cannot be overwound, nor wound twice in succession, without an intervening exposure. If, on the other hand, it has not been rewound at all, it will be found impossible to set it off, and thus to make exposures of indefinite speed. Absent-minded photographers will doubtless consider this a beneficent arrangement.

*Make it a habit never to wind the Shutter until the Film previously exposed has been discharged from the holder.*

This will render it impossible for two pictures to be taken upon the same film, and the operator will be spared the mental anguish involved in an attempt to recollect whether the foremost film in the holder has been exposed or not.

### SETTING THE SHUTTER.

On the bottom of the camera, near the front, will be seen a brass plate having an elongated orifice which is closed by a slide. This slide is shown in Fig. 8, where it is lettered S. Push this slide entirely open. The lower portion of the circular shutter will thus become accessible, and the shutter time-plate of white metal may be readily adjusted upon the shutter disc.

For those who may be interested in the principle of design embodied in the Frena Shutter, it may be remarked that the variations in the duration of exposure are effected by varying the size of the aperture which is actually passed across the lens. The shutter disc itself always runs at one and the same speed, and thus the exposures effected by this system are maintained in a definite and unalterable ratio. In this respect the Frena Shutter differs advantageously from those shutters in which the variation of speed is brought about by varying the tension of a spring, the impelling force of which is subject to constant change, and can in no wise be so regulated as to work in any definite ratio.

When the Frena is sent out from our manufactory, the Shutter is set to a speed of  $1/20$ th of a second, this being, perhaps, the most generally useful exposure for well lighted landscapes and street views.

*In order to set the Shutter to any of the other fractions of a second to which it is adapted, let it, first of all, be wound as directed above. Then introduce the first or the middle finger of the right-hand into the before-mentioned orifice at the bottom of the camera. The Shutter Time-plate of white metal, which is provided with notched edges, should then be very slightly pressed forwards, i.e., towards the lens end of the camera, so as to release it from engagement with the shutter disc. When thus released the time-plate may be so rotated, forwards or backwards, as to bring the other exposure*

*numbers which are engraved thereupon into the centre of the lens aperture, when the time-plate will be found to so re-engage with the shutter disc as to prevent the relative position of these two parts from being unintentionally altered. The engraved numbers indicate fractions of a second.*

Ascertain that the chosen exposure number is in the centre of the lens aperture, and that the time-catch has snapped into engagement with the time plate, so as to be securely held.

### SETTING FOR TIME EXPOSURES.

The shutter being wound, first adjust, as before directed, the shutter time-plate so that the exposure number  $\frac{1}{8}$  appears in the centre of the lens. A time exposure of any duration may then be commenced by *pulling out* the shutter set-off H. Fig 3. Pulling out the set-off bolt opens the lens. The head of the set-off bolt will be found to be so reeded as to be readily nipped between the thumb and finger nail. The lens will remain open

whether the operator lets the set-off bolt snap back or not. A time exposure is terminated by *pressing in* the set-off bolt in the same way as above directed for rapid exposures. Pressing in the set-off bolt closes the lens.

Thus, whereas pressing in the set-off bolt causes the shutter plate to make an entire revolution, giving an instantaneous exposure of the designated duration, pulling out the same set-off bolt (when the shutter has previously been set to  $\frac{1}{5}$ ), causes the shutter plate to revolve but partially,—opening the lens until the set-off bolt is pushed in again to complete the revolution.

Further advice concerning this operation will be given in Section 9, which deals more particularly with Time Exposures.

## Section 5.

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### ON THE FUNCTIONS & USE OF THE STOPS.

WHEN the aperture of a photographic lens is reduced by the insertion of diaphragms (or, as they are commonly called, "stops") the effect is twofold. In the first place the depth of definition and flatness of field of the lens is increased; in the second place the time of exposure requisite for any given condition of subject and light is protracted.

The term "depth of definition" signifies that portion of the field of view, measured along the axial line of the lens, which will be portrayed upon the sensitive surface with sharpness. Our standard for sharpness is based upon the fact that the disc of confusion (as opticians term the imperfect convergence of light rays by the lens) should be less than one hundredth of an inch; compare in this regard the remarks on the movements of the object, p. 58.

In rectilinear doublets of the highest class, such as the "Autograph" lenses of the Frena series, this depth of definition has a

considerable extent, even when the lens is opened to its maximum width. The lens of the Frena No. 2 works at its normal aperture, as sent out, with a diaphragm equal in diameter to one eleventh of its focal length (F. 11 or U.S. 8, *i.e.*, having an intensity of 8 according to the Uniform Standard of the Photographic Society of Great Britain). With this largest diaphragm the edges of the plate will show a sharp image of all objects which are situated not nearer to the camera than about 15 feet, and not more distant from the camera than some 100 yards. In the centre of the plate the images of all objects not nearer than 20 feet will be sharply defined with this diaphragm:—the field of such definition extending in depth to the very horizon, that is to say to infinity.

But if we introduce into our lens a diaphragm which reduces the aperture to one sixteenth of the focal length (F. 16, or U.S. 16) the images of all objects lying between the horizon and a plane 14 feet distant from the camera will be reproduced with sharpness upon all parts of the plate.

If the aperture be still further reduced to one twenty-second of the focal length (F. 22, U.S. 32) the images of all objects lying between the horizon and a plane ten feet distant from the camera will become sharp all over the plate.

For the benefit of the scientifically minded this fact may be put more explicitly by saying that increased definition is obtained by the smaller diaphragms narrowing the pencils of light which pass through the lens, thus preventing the transmission of those marginal rays which would not unite upon the sensitive surface to a pictorially sharp focus. Those who wish to acquire further information concerning the nature of diaphragms cannot do better than read the fifth chapter of the little work recently published by Traill Taylor, J., "The Optics of Photography and Photographic Lenses," London, 1892 (Whittaker).

Let it be clearly understood, however, that we purchase these advantages of increased depth of definition and of flatness of field, at the expense of rapidity: the exposure requisite for any given case being increased in the ratio indicated by the U.S. number above quoted. Thus if a certain view in a certain light is



known to require an exposure of 1 second with the first or largest diaphragm, with the second diaphragm this exposure will have to be increased to 2 seconds, and with the third to 4 seconds, this progression corresponding to the ratio between U.S. 8, U.S. 16 and U.S. 32.

For use with the swing back (which, as will be explained hereinafter, throws the top and bottom of the sensitive surface more or less out of the normal focus), a fourth diaphragm is provided, equal to but one sixty-fourth of the focal length of the lens, and corresponding to U.S. 256. When this fourth stop is employed the exposure which would be necessary if the lens were working at full aperture must be multiplied by no less than 32.

The respective U.S. numbers, indicating, as above set forth, the ratio in which the normal exposure at full aperture must be increased, are engraved upon the rotary diaphragm plate, and will be seen, on looking into the lens, immediately beneath each circular stop aperture which is turned into the centre thereof.

*In order to bring the stops into position let the rotary diaphragm plate C. Figure 18, be turned by means of the stop handle F, which, in order to decrease the aperture, should be moved in a direction contrary to that in which the hands of a clock advance.*

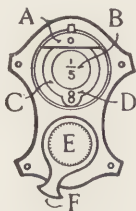


FIG. 18.

*As each circular aperture of the diaphragm plate reaches the centre of the lens a gentle click will be detected, and care should be taken that the plate is brought into engagement with the spring catch which causes this click. The best definition is not obtainable unless the aperture in the diaphragm plate is thus located in the exact centre of the lens.*

It is not difficult to form a judgment, after a consideration of the facts stated at the opening of this section, as to which classes of subjects require the employment of stops. If, as is perhaps the case in the majority of exposures, such as street scenes and figure subjects generally, the view to be photographed contains no objects of importance which are nearer to the camera than 15 or 20 feet, and if a microscopic definition is not essential for the horizon at the edges of the plate, the lens may work at its full aperture and at its maximum rapidity. For open landscapes, especially when taken lengthwise, it is, however, often desirable to have the horizon perfectly sharp throughout its entire extent, and this may be assured, usually without a protraction of the exposure so great as to interfere with the use of the camera for hand-work, by placing the second stop (U.S. 16) in the lens. In those rare instances where an extended horizon is to be rendered with a perfectly sharp definition, and where objects of importance which are as near to the camera

as 10 feet are to appear in the picture, the third stop (U.S. 32) may be employed, and the exposure quadrupled. And, finally, it will seldom be advisable to make use of the swing back without having recourse to the smallest stop of all (U.S. 256), and providing the camera for this purpose with some fixed support.

When objects nearer than 14 feet are to be photographed, and when, as is the case in most portraits and pictures of small objects, the horizon need not be taken into account, it will generally be found preferable to work with the lens at full aperture, and to employ in conjunction with it one of the Frena Magnifiers, full directions for the use of which will be found in the following section.

It is a good general rule to turn back the stops to U.S. 8 after each employment, thus leaving the lens open to its full aperture, so as to have the camera in readiness for a snap shot at figures in motion, with the shortest possible exposure.

*RESUMÉ.*

**First or Largest Stop, F. 11 or U.S. 8.**

**Full Aperture Exposure Ratio 1.**

The unit of our calculation.

**Second Stop, F. 16 or U.S. 16.**

**Exposure Ratio 2.**

With this stop the duration of the exposure at normal aperture should be doubled.

**Third Stop, F. 22 or U.S. 32.**

**Exposure Ratio 4.**

With this stop the duration of the exposure at normal aperture should be quadrupled.

**Fourth Stop, F. 64 or U.S. 256.**

**Exposure Ratio 32.**

With this stop the duration of the exposure at normal aperture should be multiplied by thirty-two.

### Private Note.

*(To the experienced and sapient Frenographer only.)*

We may confide to you a fact concerning the capabilities of your apparatus which there was no need that you should know whilst yet you were a beginner. The lens of the Frena No. 2 will work just as well at the extreme aperture of F. 8, or U.S. 4 as any lens that has ever been put, with great trumpetings as to rapidity, into other hand cameras. As well as the very best, and a great deal better than most.

But, inasmuch as half the failures of hand camera work on the part of beginners are to be ascribed to that want of depth of definition which is by optical laws inseparably connected with so wide an aperture, we have judged it unwise to thrust so delicate a pictorial tool into the hands of a novice. Hence we advise you not to avail yourself of this privilege until you feel sure that you can make wise use of it.

To use the lens in the Frena No. 2 at its extreme aperture, unscrew and remove the winding knob of the shutter by turning it backwards; slip off the stop handle, and the leathered front of the case can readily be taken out. It will then be seen that a small round-headed screw is inserted in the lens mount, just above the lens aperture. Take this screw out, and it will be found that the diaphragm plate may thenceforth be turned entirely aside, so as to leave the orifice of the lens altogether without a diaphragm, and limited only by the mount itself. This aperture is F. 8, or U.S. 4.

It stands to reason that but half the normal exposures at F. 11, or U.S. 8, will be found necessary when the lens is thus stripped. By this means extremely rapid exposures may be made of objects in motion, the definition of which will be unimpeachable, provided they are not nearer to the camera than about 25 feet, and not more distant than say, 100 yards.

Let the Frenographer receive this information without prejudice, as solicitors are wont to say, and avail himself judiciously of the advantage afforded.

## Section 6.

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### ON THE EMPLOYMENT OF FRENA MAGNIFIERS.

As set forth in the foregoing section, the Frena No. 2 is provided with a lens which, while working at the full aperture (U.S. 8) requisite for rapid hand exposures, will give well defined images of objects which are as near to the camera as 15 or 20 feet. If however, we should attempt to take portraits or to make prominent pictures of comparatively small objects, such as animals, architectural details, curios, flowers, &c., we should generally find that, when the camera is removed as far from the subject as 15 or 20 feet, the result would be a reproduction upon too small a scale. It is true that, as hereinbefore explained, we possess in the stops a means of so extending the depth of

focus that objects as near to the camera as 14, 10, or even 6 feet, will be well defined. But these stops may involve a protraction of the time of exposure so great that, in the first place, the use of the camera in the hand becomes impossible; and in the second place, animate beings or other objects in motion, cannot be taken at all.

The Frena Magnifiers have been designed for the purpose of overcoming these drawbacks. When employed as accessories to the lens, they have the effect of bringing the field of sharp focus nearer to the camera, while sacrificing the distance, so that exposures may be made with the full aperture of the lens, and consequently at its maximum rapidity. The magnifiers thus produce exactly the same practical results as does the racking out or 'focussing,' of an ordinary tripod camera.

The Frena Magnifiers comprise a set of four convex glasses, mounted in brass rings which fit the lens aperture, into which any one of them can be readily inserted, as required, without interfering in any way with the action of the shutter or of the stops. These glasses



have carefully calculated and worked curvatures, the effect of which, when used as accessories to the lens, is to slightly decrease the focal length of the main objective, or, in other words, to bring its pictorial focus nearer to the camera.

Thus the Magnifier No. 1, of most shallow curvature, so approaches the plane of focus that all objects which are situated between 32 and 9 feet from the front of the camera will be reproduced with good definition when the lens is used at its full aperture (F 11, or U.S. 8), while those objects which are beyond 32 feet will become more or less indistinct unless the depth of focus be extended by the employment in conjunction therewith of one of the smaller stops.

In like manner the Magnifier No. 2, so alters the focal plane of the lens as to cause it to lie at full aperture, between  $10\frac{1}{2}$  and 6 feet from the front of the camera; the Magnifier No. 3, causes the focus to lie between 6 and  $4\frac{1}{2}$  feet; and the Magnifier No. 4, with the most convex curvature, causes the focus to lie between  $4\frac{1}{2}$  and  $3\frac{1}{2}$  feet.

The size of the photographic image, depending as it does upon the distance of the object from the camera, may be ascertained by means of the following approximate table:—

Magnifier  
to be used.

Object 3 ft. 8 in. from camera,	
gives picture $\frac{1}{8}$ natural size ...	No. 4.
„ 5 ft. 6 in. from camera,	
gives picture $\frac{1}{12}$ natural size ...	No. 3.
„ 7 ft. from camera,	
gives picture $\frac{1}{15}$ natural size ...	No. 2.
„ 14 ft. from camera,	
gives picture $\frac{1}{30}$ natural size ...	No. 1.

## RESUMÉ.

**Frena Magnifier No. 1.**

*Gives, with the lens at full aperture, a sharp image of all objects lying between 32 feet and 9 feet from the front of the camera.*

**Frena Magnifier No. 2.**

*Gives, with the lens at full aperture, a sharp image of all objects lying between 10½ feet and 6 feet from the front of the camera.*

**Frena Magnifier No. 3.**

*Gives, with the lens at full aperture, a sharp image of all objects lying between 6 feet and 4½ feet from the front of the camera.*

**Frena Magnifier No. 4.**

*Gives, with the lens at full aperture, a sharp image of all objects lying between 4½ feet and 3½ feet from the front of the camera.*

It must be borne in mind that when a magnifier is employed in conjunction with the lens working at full aperture, sharp pictures will only be obtained of those objects which are situated within the above limits.

## Section 7.

### ON THE USE OF THE SWING BACK AND LEVEL.

When the holder containing the sensitive films is in its normal position, at right angles

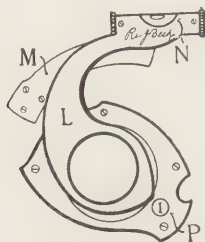


FIG. 19.

to the axis of the lens, the handle outside the case is held in engagement by a spring

register-catch (M, Fig. 19). We recommend the beginner in photography to take his first pictures with the handle thus engaged. The Frena is then in the same condition, as regards the relative positions of sensitive surface and lens, as that which always obtains in every other kind of hand-camera. It is a well-known fact that every picture which is taken with such cameras, when they are not held absolutely horizontal, is more or less out of perspective: lines which are in reality vertical and parallel appearing in the photograph to be inclined and convergent. In figure subjects and in landscapes pure and simple, *i.e.*, containing no buildings, this distortion of perspective caused by tilting the camera does not often constitute a serious defect.

The beginner can therefore take satisfactory photographs of subjects of this nature, although, while tilting the Frena, he permits the handle to remain in engagement with the register-catch.

When, however, he turns to views of buildings on a large scale, to street scenes,

and, indeed to the representation of any subjects comprising a series of upright lines, he will find that the before-mentioned distortion assumes formidable proportions. Among the customary defects of hand-camera work, none are more distressing than "drunken architectures": those inclined and tumbling lines which misrepresent buildings in reality perfectly vertical and parallel.

But with the Frena hand-camera, even though it be tilted up or down, it is possible to take pictures in correct perspective. It possesses an adjustment, technically known as the Swing Back, which has hitherto been found only in the more expensive forms of tripod cameras.

In the top of the handle is mounted a small spirit-level (N. Fig. 19). If the handle be engaged in its normal position by the register-catch, the bubble of this level will, when the camera is held absolutely horizontal, be in the middle of the tube. If, on the other hand, the handle is released from the register-catch, and is turned forwards or backwards, according as the lens end of

the camera is inclined upwards or downwards, the bubble will be in the middle of the tube when the sensitive surface of the Film within the camera is actually parallel to the vertical lines of the picture. This is the essential requirement of correct photographic representation, as may be ascertained from the study of any work treating of the principles of photographic optics. For upright pictures, the Frena Level provides us with a simple and accurate test of this parallelism. Whatever may be the position of the camera, a glance at the bubble will shew whether the image formed by the lens is in correct perspective and free from inebriation.

It is obvious that the Swing Back is not available, nor will it be so often required, for horizontal pictures.

The employment of the Frena Swing Back is attended with no particular difficulty, and our suggestion that the beginner need not at first take advantage of its capabilities, has been made solely with a view to reducing the operations necessary for taking a picture to the smallest possible number. It is, as before said, never necessary or advisable to bring the Swing Back into play for views which do not comprise

prominent buildings or other objects displaying a series of straight and vertical lines. For ordinary landscape and figure subjects the adjustment should be disregarded altogether. When, however, true perspective is imperatively demanded,—as in the case of all architectural subjects,—perfect results may be obtained with a rapidity and facility hitherto unapproached.

The scope of the picture having been determined, and it having been seen from the image in the vertical view finder that all the desired features are included in the field of the lens, it will almost always be found, on consulting the level, that the camera is not being held horizontal. Were an exposure to be made under these conditions, there would be produced in the picture a distortion of perspective exactly proportionate to the angle of inclination. The handle of the Frena should, therefore, be released from the register-catch, and turned slightly forwards or backwards, as the case may require, until the bubble of the level is situated in the middle of the tube. The pressure of the register-catch will be sufficient to hold the handle steady in its new position until the picture has been taken,



—after which the handle may be turned back, and the exposed film discharged in the usual manner.

**An upright picture made when the bubble is in the middle of the tube, will, under all conditions, be in absolutely true perspective.**

Under no circumstances should the handle be moved further away from its normal position than is absolutely necessary ; better no correction at all than an overcorrection, the effect of which is peculiarly offensive to the eye.

Moreover, the handle should not be moved, whether forwards or backwards, unless a small stop is employed for the purpose of increasing the depth of focus of the lens, as explained in the fifth section. It is an optical impossibility to use a Swing Back of any form without "straining" the definition and covering power of the lens. When portions of the sensitive surface are moved towards or away from the lens, they are, of course, moved out of its exact focus.

*Hence, a limit has been set to the employment of the Swing Back in the Frena No. 2, rendering it impossible to take a picture with the handle turned away from its register by more than three-quarters of an inch.*

This would correspond to and correct an inclination of the camera equal to about twenty-five degrees. This permits the perspective to be corrected to an enormous extent, and the smallest stop (U.S. 256), should invariably be employed when the displacement of the handle amounts to even one half thereof. Otherwise a marked falling-off of the definition at the bottom, and especially at the top of the negative, would make itself apparent.

Yet, even this defect would be preferable to the horrors of a distorted architectural perspective.

## Section 8.

### ON HOLDING THE FRENA AND MAKING HAND EXPOSURES.

Before making an exposure, the lens cover plate (A. Fig. 20) must be pushed up as far as it will go, so as to entirely uncover the lens aperture.



FIG. 20.

When the Frena is not in use, it is well to push this plate, for the purpose of preventing the access of dust to the lens, and of rendering the camera less conspicuous by concealing the bright surface of the glass.

Carefully choose the standpoint most suitable for taking the picture, and approve of the grouping as displayed in the finder (concerning which compare Section 1).

**The exposure may then be made by gently pressing in the bolt which projects from the right-hand side of the camera, near the lower front corner (H. Fig. 21). Continue this pressure until the click of the revolving shutter is heard.**

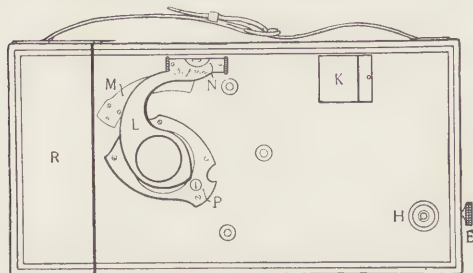


FIG. 21.

In performing this simple operation, there is only one point which requires attention: a point, however, of the very greatest importance.

**The camera must be absolutely motionless during the act of exposure.**

Although the time which elapses during the revolution of the shutter-plate is but a small fraction of a second, any shake or twist that may be given to the apparatus during this period will inevitably mar the sharpness of the image. To take a picture which shall be altogether free from blur, especially by any exposure longer than  $1/40$ th of a second, the camera must be held steadily, and the set-off must be released by gentle pressure, not by a jerk.

The Frena is provided with a shutter which has the great advantage of giving the possibility of much slower exposures than those practicable with most hand cameras. But hand in hand with these slower exposures there inevitably goes an increased danger of the camera being shaken through careless holding. Let the beginner fully recognize this danger and be on his guard.

### HOLDING.

The manner of holding the camera, unimportant as it may at first appear, exercises a direct influence upon the finished picture, and care bestowed upon this point will always prove to be well repaid.

To hold the Frena with the greatest possible firmness it should be grasped by both hands, all the fingers being spread out upon it with the exception of the forefinger of the right hand, which should be left in free play for the purpose of pushing in the shutter set-off at the chosen instant. Compare Fig. 22. When the picture is taken horizontally, the set-off may be pressed in by the thumb of the right hand.

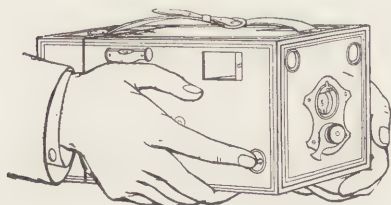


FIG. 22.

The apparatus should not be held at arm's length, but should be pressed firmly against some part of the body, so that an additional support may thereby be obtained. There

are two chief ways of doing this: The one by holding the back of the camera against the chest, the other by holding its side against the right hip, or, a little higher, under the right arm. The individual convenience of the operator will guide him in his ultimate choice between these two methods.

Let him refrain from drawing breath at the very moment of releasing the shutter set-off, and let him endeavour to prevent his body from swaying sideways. By due attention to these points he will obtain the best results possible under the circumstances of any hand exposures. Individuals, as before remarked, differ greatly in natural steadiness of nerve and hand; but by a little practice even the most nervous should thus be enabled to give hand exposures of one-twentieth or even one-tenth of a second.

If any fixed support be at hand, such as a wall or the trunk of a tree, it is most advisable to lean the body or rest the Frena against it. Where the character of the view does not render it necessary that the camera should be elevated more than a couple of feet above the ground, the photographer, may sit down, and hold the apparatus upon his knees. Moreover, the Frena itself, as it has the

shutter set-off on the side, and not at the bottom of the case, may, for vertical as well as for horizontal pictures, often be rested upon some stable support, such as a gate or the parapet of a bridge. This will do much in the way of insuring steadiness. *In the case of all time exposures, some such fixed support is imperatively required.* Hints concerning this class of work will be given in the following section.

The steadiness of the Frena having thus been the object of the photographer's special care, he must be on his guard against disturbing it by the act of making the exposure.

**The set off bolt should be pressed in so gently and gradually that the camera is not moved at all through the force applied by the forefinger.**

Whatever pressure is given by the right hand must be exactly counterbalanced upon the other side of the camera by the left hand. A marksman is always instructed by his drill-serjeant to compress and not to pull the trigger of his rifle, and a similar care should be exercised by the user of a hand



camera in the delivery of his more peaceable shot. In the Frena, the resistance offered by the spring of the set-off bolt is weak, and it is perfectly possible, with a little precaution, to release the shutter without giving the slightest thrust to the camera case.

If, through want of attention to these directions, the beginner finds his pictures to be blurred, let him by no means lay the blame for this upon the definition of the altogether excellent Frena Lens: rather let him see to it that the duration of his exposure is not so long as to render it inadvisable for him to support the camera by hand alone,—that he trains himself to hold his camera steadily,—and that he does not give it a sideward jerk by the act of setting off the shutter.

### RESUMÉ.

*Before each exposure.*

**Make sure that the Lens Cover-Plate is pushed up.**

**Make sure that the proper Stop is in the centre of the Lens.**

**Make sure that the Shutter has been wound.**

**Make sure that the Shutter Time-Plate has been set to a suitable length of exposure.**

*Hold the Camera steady!*

*Press in the Shutter Set-off gently!*

## Section 9.

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### TIME EXPOSURES.

THE shutter being wound, and the lens cover-plate being pushed up, set the time plate as

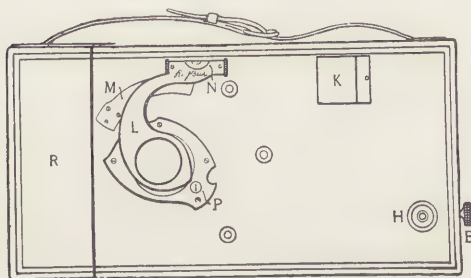


FIG. 23.

directed in Section 4, so that the exposure number  $1/5$  is visible in the centre of the lens aperture.

To commence a time exposure: Gently *pull out* the Set-off bolt (H. Fig. 23) in the manner described at the end of Section 4. This opens the lens.

Determine, by means of a watch, the exact duration of all time exposures longer than three seconds.

To end a time exposure: Gently *press in* the Set-off bolt in the manner customary for rapid exposures: On doing this, the shutter will be heard to click, as the course of its further revolution is arrested. This closes the lens.

If the operator finds that he is liable to shake the camera and blur the image by pulling out and pushing in the Set-off bolt, he may try the effect of making time exposures by sliding the lens coverplate up and down after the lens has been opened, or of gently holding a red handkerchief, a cap, or a felt plug over the aperture, until after the lens has been opened and before it is again closed.

The exposed film should then be discharged and the shutter re-wound.

As before said, it is absolutely necessary in the case of all time exposures to place

the Frena upon some fixed support. This support may be any object having, at a convenient height, a level surface not smaller than the bottom of the camera. The top of a wall, the balustrade of a bridge, a window sill, mantel-piece, or a table, will often be found available for this purpose. In the great majority of cases it will not be advisable to place the camera upon the earth, owing to the consequent exaggeration of the foreground; yet a satisfactory arrangement of the picture may occasionally be thus obtained, as for instance, when the point of view is the brink of a gorge or other declivity.

If the grouping renders it desirable to incline the axis of the lens slightly upwards or downwards, this can be done by propping one end of the camera upon some object of suitable size and shape, such as a bit of board or a walking stick. Even a folded handkerchief placed beneath one end of the Frena will be found to make an appreciable difference in the scope of the picture.

Whatever the nature of the support, the camera must be free from any tendency to wobble, or otherwise to alter its position during exposure. Unless the exposure is

very long, say more than four or five seconds, or unless the support is not absolutely rigid, it is advisable to keep the left hand pressed firmly downwards upon the top of the camera during the operation, thus counteracting the slight pull and thrust which has to be given to the shutter set-off.

Undoubtedly the most convenient and universally practicable way of supporting the camera is to attach it to a tripod stand, for the use of which the Frena No. 2 is especially adapted, being provided with brass tripod screw seats both upon its bottom surface, for upright pictures, and upon its left hand side, for horizontal pictures.

If the Frenographer enter upon the pursuit of his art with sufficient interest and sufficient patience to tolerate such an encumbrance, let him by all means supply himself with some one of the various forms of folding or walking stick tripods. But let this be of the best quality and as rigid as possible. A rickety stand is a thing to be execrated, and cannot serve for the production of a good picture; better none at all.

A tripod screw, for use with a tripod, accompanies each camera; by means of this the Frena may be

quickly and securely attached. It will only be necessary at the first time of usage, to break through the coating of leather upon the bottom and the left hand side of the camera, when the screw can be inserted and tightly turned home. The location of these seats may be discovered by probing the leather with the point of a pin.

Beginners sometimes find difficulty in erecting a tripod, owing to their placing its legs at insufficient and unequal distances upon the ground. Let the tripod be opened widely enough to stand firmly, and let one leg be pointed directly at the view to be photographed. The camera may then be tilted upwards by drawing this foremost leg inwards, or downwards by pushing it further away. In order to keep the transverse axis of the camera horizontal, so that the vertical lines of the picture may be parallel to the sides of the film, the two legs at the back should always form the base of an equilateral or isosceles triangle. Of course the camera, if approximately horizontal, may be turned somewhat to one side or the other by swivelling it upon the tripod screw, without shifting the position of the legs.

When the tripod is to be erected upon a slippery surface, such as a polished pavement, it may be advisable to stick corks upon the iron tips of the legs, or to encircle these with a loop of string.

Extreme care should be exercised not to shake the camera in making time exposures upon a tripod stand. Compare the warning given on page 96.

Concerning the length of time during which the lens should be left open, for time exposures, it is not practicable to give instructions more definite than those which are contained in Section 3. As time exposures need be given only in the case of exceptionally dark subjects, or under exceptionally weak illumination, it is obvious that no rules could possibly prove of general application.

### INTERIORS.

In the case of pictures taken indoors, time exposures will almost always be found to be absolutely necessary.

When taking the photograph of an interior, certain precautions should be observed in selecting a stand-point for the camera, and in determining the scope of the picture by means of the finder. If circumstances render it possible to so arrange it, no windows should be included within the field of the lens, as the direct glare of light admitted through them will tend to blur the image. Thus the most advantageous stand-point for the Frena will usually be found to be close to that wall in which the windows are pierced. If the room be at the corner of the building and be provided with windows on two of its sides, the

outermost angle will almost always be the best position. Should it, however, prove impracticable to exclude all the windows from the picture, it will be a good plan to diminish the light from those which come within the field of the lens, by pulling down their blinds or by drawing their curtains.

The time required for exposures in interiors is subject to enormous variations, dependent upon the amount of light admitted to the room, and upon the colours of the walls and hangings. On a summer noonday, with bright sun out-of-doors, a small room lighted by two windows, and having white or very light coloured walls, would probably not require a longer exposure than one or two seconds. But a case has been referred to above (page 51), where a large hall with dark panelling, in subdued light, was found to require an exposure nearly *five thousand times as long* as that which sufficed for a view of the exterior of the building.

The writer is acquainted with an eminent authority who invariably replies, when asked what length of exposure should be given to this or that interior, "try five minutes, and then see what you get on your negative." Interiors, fortunately enough, do not



belong to that class of transitory subjects which present themselves but once to the vision of the photographer ; they stand steadily, and can be taken again and again, until a satisfactory result is at last secured. If the interior be that of a house which is provided with a photographic dark room, it will be advisable to at once develop the film upon which the view is taken, and, guided by the indications of under or overexposure thus obtained, to repeat the operation with the duration of the exposure considerably modified.

## Section 10.

### ON CHANGING THE FILM.

As soon as a picture has been taken, the exposed film should be discharged from the holder and transferred to the receiving chamber.

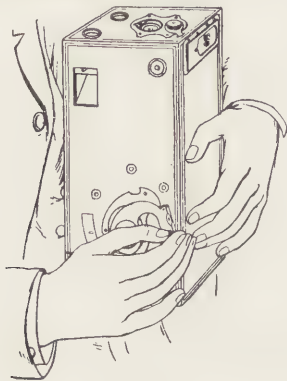


FIG. 24.

To do this let the camera be first turned so that the front is uppermost, with the lens pointing to the zenith.

**Then release the handle from the spring register-catch and turn it backwards and downwards (*i.e.*, in a direction contrary to that in which the hands of a clock move) as far as it will go, or a little more than one half a revolution (Fig. 24).**

Turn the handle slowly and steadily, and do not reverse it until it is felt to bear against the stop which sets a limit to its further revolution. Allow the handle to rest at the end of its journey for a fraction of a second. This will give the released film time to drop.

**When the handle has gone round as far as it will go, it must be turned back again to its normal position, into engagement with the register-catch.**

The Frena must be held with its lens end uppermost until these manipulations have been completed, otherwise the discharged film might be deposited elsewhere than in the receiving chamber, to the detriment of subsequent exposures.

These operations discharge the foremost film, with its accompanying card, and at the same time bring the succeeding film of the pack into the exact focus of the lens, ready to receive the next photographic image.

## Section 11.

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### ON READING & SETTING THE INDICATOR.

It will be observed that a small circular aperture is pierced in the metal escutcheon



FIG. 25.

which surrounds the axis of the handle (P. Fig. 25). The numeral visible through this aperture shows the number of the film

which is in position for the next exposure. Every time that the handle is turned down, one photographic film, with its accompanying backing card, is deposited in the receiving chamber, and at the same time the indicator is advanced one number. The numbers upon the indicator run from 1 to 20, corresponding with the score of films contained in each pack. When the twenty-first film is in position, the indicator will begin again at 1.

It is advisable, when replenishing the Frena, to put an entire pack of twenty films into the holder at once, as directed in the following section. If this be done, and if care be taken to refill the holder before the previous charge is entirely exhausted, that is to say, while at least one unexposed film, with its backing card, remains therein, it will never be necessary to employ a dummy film for the purpose of loading, and never necessary to change the indicator reading.

If the Indicator is disarranged, it may, when the holder is completely empty of films, be shifted so as to show any one of its numbers by turning down the handle once for each change to a consecutive number,

as many times as may be necessary. It is important that the spring-back board should remain in the holder whilst it is being thus revolved.

To avoid all necessity of troubling himself with this process, the photographer is again advised to always replenish the holder with an entire pack of twenty films at once, and never to discharge the last, twentieth, film of the former series until the new pack has been placed in the holder behind it. This last, twentieth, film of the previous series may, of course, be exposed in the field; but it is a good plan to leave it in position in the holder until the Frena is taken into the dark room and refilled, after which operation the twentieth film (which has thus a function comparable to that of a "caretaker" left in a house between two sets of occupants) may be discharged from the holder for development.

## Section 12.

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### ON REMOVING EXPOSED FILMS AND RECHARGING.

BEGINNERS in photography must be reminded that the films employed in the Frena are extraordinarily sensitive to light, whether artificial or daylight. The high degree of this sensitiveness may be judged from the fact that the light of the sky even though admitted only through the comparatively small aperture of the lens, and for the inconceivably short period of one-thousandth of a second, is sufficient to produce, on development, a dense black deposit upon any film exposed thereto. Hence, although the process of introducing the films into the Frena requires but a few seconds, the only light by which this operation can be safely performed is that given by the subdued deep red illumination of a photographic dark-room.

It is scarcely necessary to add that the receiver at the back of the Frena ought never to be removed excepting in such a dark-room. If the faintest ray of white light gains access to the films, all the photographs will be hopelessly fogged.

Those operators, however, who have not access to a regularly constructed photographic dark-room, can almost always arrange for themselves a temporary substitute which will suffice for the changing and packing, if not for the development, of their films. The writer has often, in broad daylight, shut himself into a tightly-closing hotel wardrobe for the purpose, or improvised a diminutive tent by propping up the bedclothes upon an open umbrella. A more comfortable plan is undoubtedly to wait until night-fall, when the windows and doors of most rooms can be completely shut off from the lights of the street and corridors by blinds and hangings. The necessary illumination may then be derived from a folding ruby lamp,—from the stump of a candle placed in a hat-box and securely shielded by several thicknesses of red tissue paper,—or even, in extreme destitution, from the glowing end of a post-prandial cigar.

One of the many advantages of Frena Films is that, as they are supplied by the makers in a firm pack, which can be placed in the camera without being separated, only the foremost sensitive surface need be



exposed to the dark-room light at all. Light-fog will thus but rarely be found to extend beyond the first film.

#### A.—TO TAKE OUT EXPOSED FILMS.

It is one of the advantages of the Frena system that any single film that has been discharged from its holder can be withdrawn from the receiver for development without disturbing the stock of films which have not been exposed. There is no cutting up or waste of negative material involved in removing the films one by one, as may be convenient. On the other hand, the entire charge of films contained in the Frena can, if preferred, be exposed consecutively, and not removed from the camera until the apparatus is to be refilled.

The removal of exposed films from the Frena is an operation of the utmost simplicity.

**In a photographic dark-room remove receiver from the door at the back of the case by unbuckling the strap-handle, and unfastening the spring-catch**

which is beneath it. The exposed films, interleaved with their backing cards, will be found lying in a pack, sensitive side downwards, within the Receiver, whence they may readily be removed by grasping them between finger and thumb (Fig. 26).

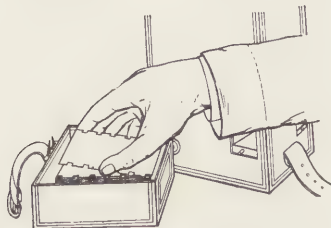


FIG. 26.

The photographer should refrain from touching his films at all, unless he is sure that his fingers are perfectly dry and free from traces of photographic chemicals. In any event, he should handle the sensitive surface as little as possible, grasping the films, whenever practicable, only by the back and edges. The imprint of damp fingers upon the bromide of silver emulsion will almost always become visible on development, and such marks do not improve the appearance of the finished picture.

After being removed from the camera the pack of exposed films must be at once protected from the light. At least four thicknesses of non-translucent paper, securely folded, will be required for this. The best methods of packing exposed films are, undoubtedly, to enclose the pack in the set of envelopes which are supplied for the purpose, or to employ, for rewrapping, the tissue paper, black paper and cardboard boxes from which the next pack of fresh films is taken.

If such packing materials of known efficiency be not at hand, the Frenographer must make shift as best he can. He should bear in mind that it is generally safer to take for the innermost wrapper, which comes in contact with the films themselves, a thin brown paper, rather than any kind of white paper, inasmuch as the latter often contains hyposulphite of soda (a chemical most destructive of the sensitive surface), which is used by many paper makers as an anti-chlor in the process of bleaching. Brown papers are sold at so cheap a price that it would not pay the manufacturers to put chemicals of any kind into them.

If the exposed and undeveloped films are to be sent about the world by post, it is well to reduce their bulk and weight by removing

the packing cards from the pack, otherwise it is preferable to leave these cards between the films, where they often serve as light-shields.

When the films are securely packed, they should be at once sealed, so as to prevent the opening of the wrappers through accident or meddlesomeness. The full development of the faculty of inquisitiveness, in the case of hotel servants, as well as other members of the human species, is known only to that photographer who puts away packages of exposed plates in unsealed wrappers. And this is a form of knowledge, the acquirement of which is not attended with satisfaction.

#### B.—FRENA FILMS.

The Frena, as is well known, takes pictures on thin and stiff sheets of transparent Cellulose Film, the only perfect substitute for glass yet invented. These sheets are almost exactly one-hundredth of an inch thick, that is to say, about the thickness of a visiting card. They are so prepared as to remain perfectly flat during exposure. Even after development they have but little tendency to curl.

The Films used in the No. 2 or quarter plate Frena are four and a quarter inches long, and three and a quarter inches wide. The weight of twenty such films is only one ounce and a half, whereas the weight of twenty glass plates of the same size is as many pounds.

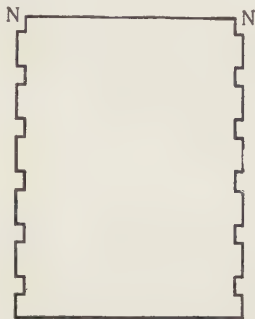


FIG. 27.—QUARTER PLATE FRENA FILM.

*Actual size,  $3\frac{1}{4}$  by  $4\frac{1}{4}$  inches.*

The edges of each film are notched, as shown in Fig. 27. Between each film is packed a thin card or backing of the same outline, lying with its notched corners in the

same direction so as to be discharged together with the film to which it appertains. The purpose of these cards is to prevent the light admitted through the lens from penetrating to the sensitive surface of the succeeding film. At the same time they almost entirely obviate that blurring of the image caused by light reflected from the back of the negative, which is technically termed halation.

Frena Films are prepared by various manufacturers, whose products differ in certain particulars, and notably in respect to the character of the sensitive emulsion. Each make will, in consequence, display slight peculiarities in working. The operator is strongly recommended to choose one brand, and to persevere with it until he has thoroughly mastered its treatment with the one developer which, for like reasons, he has adopted as a standard. As the owners of the Frena trade-mark permit only sensitive films of approved excellence to be supplied under this name, which may thus be taken as a guarantee, the photographer may rest assured that first-class results can be obtained with every brand, even as good negatives can be made, by suitable treatment, with every approved formula for development. Hence, it would be invidious for us to recommend the beginner to take up the films of any particular maker. We

can only assert of Frena Films what the Kentuckian asserted of his favourite beverage: When asked which brand of whiskey was the best, this just and cautious man replied that some might be better than others, but all were good!

Certain precautions should, however, be observed in the storage of films, as of glass dry-plates. The packages should be carefully protected from dampness, to the influence of which all sensitive photographic surfaces are exceedingly susceptible. Passengers at sea should pack their supply in tin-foil or in air-tight tin cases. Films should furthermore be guarded from the fumes of gas, which will cause the emulsion to degenerate rapidly. They should not, for instance, be stored in any room which is lighted by gas, and, if this be unavoidable, they should not be placed on high shelves, but near the level of the floor. With proper care, Frena Films will keep their good qualities unimpaired for years, and it is one of the many advantages of films, as compared with glass plates, that the manner in which they are packed naturally tends to preserve them

more perfectly from the atmosphere, and from the deteriorating effects of moisture and gases.

For use in very hot and damp climates, notably in India and Equatorial Africa, we supply backings of black celluloid, to be used in place of, or in addition to, the usual non-translucent backings. These adjuncts will overcome any tendency of the films to adhere, even during the rainy season.

Special instructions will accompany each packet of any self-backed or stripping films which may require peculiar treatment.

### C.—THE FILM-CHANGING MECHANISM.

Before attempting to recharge his apparatus with fresh films, the Frenographer ought to understand the mechanism by means of which the separate sheets are released from the holder in which they are exposed, so as to be deposited in another pack or series upon the bottom of the camera. For this purpose he should, when the first charge of films has been exposed and removed, examine and test the interior mechanism of the apparatus in broad daylight.



Let the handle be turned to its normal position, in engagement with the register-catch upon the outside of the camera. The holder will thereby be

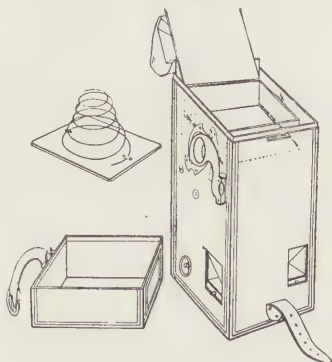


FIG. 28.

locked with its vertical axis at right angles to the axis of the lens. Upon removing the receiver at the back of the camera it will be seen that an oblong holder of metal is swung upon axes supported by the sides of the case. It is in this holder that the films, with their opaque backings, are placed, one behind the other, in alternate sequence as regards the position of their notched corners, each film having its sensitized surface

towards the lens. The photograph is taken upon the foremost film of the series.

The hinged flap which closes the holder should then be opened by unfastening the catch upon its upper edge. Folding down this flap exposes the spring pressure-board which serves to keep the films in position. (Compare Fig. 28). Remove the pressure-board, grasping it by the spiral spring. It will then be seen that the holder is quite open in front, except for a series of pointers or sorting teeth, six on each side, which project inwards to a distance of one-tenth of an inch. The foremost film will always be placed against, and supported by, these pointers.

Observe the reading of the Indicator. If it displays an *odd* number, the foremost film will lie in the holder with its notched corners *up*, *i.e.*, towards the top or strap-handled side of the camera. If the indicator displays an *even* number, the foremost film will lie in the holder with its notched corners *down*, *i.e.*, towards the bottom of the camera.

In order to test the changing mechanism, place in the holder a number of exposed and developed films, arranged in alternate sequence. The first film to be placed in an empty holder should invariably be a Dummy (Fig. 29), which is supplied by the makers

for convenience in making a first charge. This dummy Film is of precisely the same outline as the ordinary sensitized films, but it is much stiffer, so as to rest securely upon the teeth, without bending under the pressure of the hand, and it is perforated with two circular holes, so that it may be conveniently grasped.

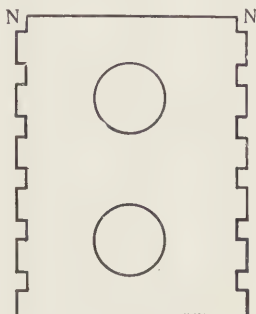


FIG. 29.

Stand the Frena upon its lens end so that the holder is horizontal, and that the films may lie face downwards. Insert thumb and forefinger in the holes of the Dummy Film, and place it in the empty holder, in such wise that it rests evenly upon the pointers, the notched corner being up if the indicator shows an odd number, and down if the indicator shows an even number.

$$\left\{ \begin{array}{lcl} \text{ODD} & = & \text{UP} \\ & \& & \\ \text{EVEN} & = & \text{DOWN} \end{array} \right\}$$

Then lay upon it a second film or dummy, with its notched corners lying in the contrary direction ; then a third film lying in the same direction as the first, and so on in alternate sequence. Replace the spring pressure-board, and close the flap of the holder.

When the camera is held with the lens pointing upwards and the holder is revolved, by means of the handle upon the outside of the case, it will be seen that, towards the end of the travel, the pointers slide along the sides of the holder until they come to the notches. The first film being thus no longer supported, drops out from the holder. The second film is, however, supported by the pointers whilst these are in their secondary position, owing to the fact that the notches in the second film are not coincident in position with the notches in the first film.

On turning the handle back so that it engages with the register-catch, and then releasing it and turning it down a second time the pointers will return to their original positions, in which they correspond to the notches in the second film, so that this latter drops on top of the first film previously deposited. It is only the foremost film of the series and its companion card which are effected by this manipulation, the remainder of the pack being retained in the holder. Turning the handle back replaces the holder in position for taking the next photograph.

Thus, it will become evident that every time the handle is turned backwards and forwards through an arc of about 190 degrees, one film and its backing

are discharged from the holder, and deposited within the receiver, leaving another sensitive surface in position in the focus of the lens, ready for the next exposure.

The series of discharged films stored in the receiving chamber are protected from the light admitted through the lens, and prevented from falling into the body of the camera, by means of a flexible septum, one end of which is attached to the bottom of the camera and the other to the flap at the back of the holder. This septum is moved out of the way of the dropping films and cards by the revolution of the holder.

#### D.—TO RECHARGE THE FRENA.

The Frenographer who has attentively followed the preceding paragraphs will have no difficulty in recharging his apparatus. Two precautions are, however, essential.

**In the first place, the Films, together with their backings, must be placed in the holder in alternate sequence as regards the position of their notched corners, that is to say, in the same arrangement as they are packed and supplied by the manufacturers.**

A film placed in the holder with its notched corners the wrong way, that is to say, in the same position as that immediately preceding

it would, of course, be discharged, together with the preceding film.

**In the second place, the sensitized surface of the films, or in other words, that side upon which the gelatine emulsion is spread, should be placed towards the lens.**

On opening the parcel of films, it will be seen that at one end of the pack is a white film, and at the other is a coloured backing. The pack should consequently be inserted in the holder with the white sheet towards the front of the camera. If a single film should become separated from the pack, the sensitized side can be distinguished by its matt surface.

If a film were, through inadvertence, placed in the camera with its sensitive surface the wrong way about, the picture taken upon it will be reversed as regards right and left.

It is a good plan to slightly bend and thus open out or "ruffle" the pack of fresh films, like a pack of playing cards, care being taken that they do not thereby become disarranged as regards sequence or relative position. This manipulation would separate any films which might have a tendency to stick together through having been exposed to damp, or having been packed before the emulsion had become absolutely dry.

Having then, in a photographic dark-room, or in its equivalent as regards non-actinic illumination, placed the Frena upon its lens end, take off the receiver, unfasten the flap of the holder, and remove the pressure-board. (Fig. 30).

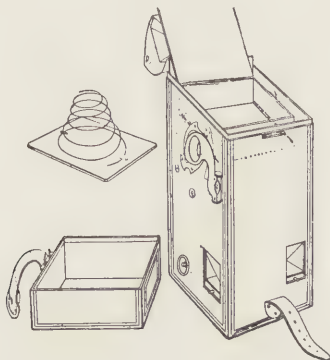


FIG. 30.

If there remain in the holder any films, with their backings, and it is merely required to add to their number, the additional films with their backings may be dropped into the holder either one by one, in alternate sequence, or as an unbroken pack.

**The foremost film of each pack must be placed in the holder with its notched corners (N, N, Fig. 31) in a contrary direction to those of the last film of the preceding series.**

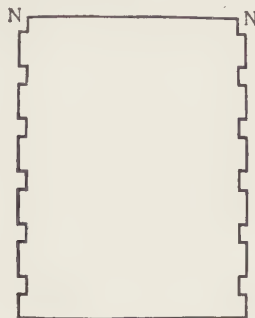


FIG. 31.

When there remains in the holder but a single film, with its backing, care should be taken that the position of this film upon the pointers is not disarranged during the process of refilling. It should not be submitted to uneven pressure by the pack inserted behind it, nor be bent down by the fingers of the operator. For the sake of perfect security in such a case, it is advisable to separate from the fresh pack the first two or three films, with their backings, and to drop these lightly into the holder, before the remainder of the series. The layer of three or four



films thus formed in the holder cannot readily be bent out of engagement with the pointers, and the rest of the pack may then be inserted without further separation.

**Not more than one entire pack of films should be added at a time, and the total number of films in the holder should at no time exceed forty.**

Replace the pressure-board, close the hinged flap, and affix the receiver to the camera. The fresh supply of films will then be ready for exposure.

By turning the handle round one quarter of a revolution, or a little more, so that the face of the holder is visible from the back of the camera, it can be seen whether the foremost film rests evenly upon the pointers, and thus insures the regular discharge of the following pack.

Care must, however, be taken not to discharge the film by turning the handle too far.

It is strongly recommended that the Frena should invariably be replenished by one entire pack at a time. Separate films, if taken from the pack, and left in their wrappers, are exposed to various deteriorating influences, from which they are secure while under pressure in the holder. Moreover, much bother and uncertainty may be entailed by such a breaking up of the pack, and by the re-arrangement in alternate sequence which becomes necessary if the films be scattered. These disadvantages will be especially

felt in the case of beginners, unaccustomed to work in the dim illumination of the dark-room. If an entire pack be always added to a few unexposed films remaining in the holder, the indicator will not only prove how many pictures have been taken, but will also show how many films are still in the camera, ready for exposure.

With this recommendation is to be coupled the advice already proffered: that the stock of films in the Frena should not be entirely exhausted before being replenished. The twentieth and last film need not be discharged from the holder until the next pack has been placed behind it.

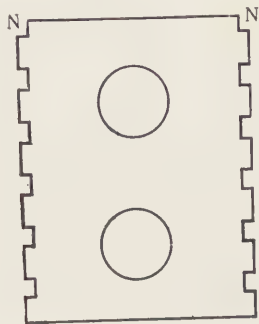


FIG. 32.

Should nevertheless, the holder be actually empty, the recharging must be begun with the Dummy Film (Fig. 32), as before

described. If a flexible cellulose film were to be introduced alone into an empty holder, it might be bent by the pressure of the hand so as not to rest evenly upon the pointers, and an irregular action in the changing mechanism would be the result. Take, therefore, the empty Frena out of the dark-room into

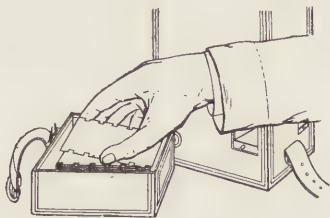


FIG. 33.

broad daylight. Set the indicator, as directed in a former section, to the numeral 20. Place in the holder a Dummy Film, with its notched corners (N, N, Fig. 32), towards the bottom of the camera, so as to rest evenly upon the pointers. Return to the dark-room, and add the pack of sensitive films, with their backings, in alternate sequence, as directed. Then replace the pressure-board,

close and fasten the flap at the back of the holder, and, after turning the camera the right way up, with the strap-handle on top, move the handle once round, so as to discharge the Dummy Film, which may be at once removed from the receiving-chamber. After this one revolution of the handle, the indicator will show the numeral 1, for the first film of the new series.

Before leaving the dark-room with a newly-filled Frena, make sure that the receiver is securely fastened by its spring catch, and that the strap, which forms an additional security against accidental opening, is buckled.

#### **FORMULA FOR RECHARGING.**

$$\left\{ \begin{array}{l} \text{ODD} = \text{UP} \\ \& \qquad \& \\ \text{EVEN} = \text{DOWN} \end{array} \right\}$$

and then

#### **IN ALTERNATE SEQUENCE.**

## Section 13.

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### ON PACKING AND FORWARDING THE FRENA AND FRENA FILMS.

ONE of the great advantages of films is that packs of exposed sheets or of finished negatives can be sent by post to all parts of the world, without danger of breakage, and at small expense. For instance, the postage payable on a package of twenty films with their cards, as supplied by the makers, is, within the limits of the United Kingdom, when sent as a sealed letter, threepence. Three such packages can be sent by Parcel Post for threepence.

When exposed and undeveloped films are to be forwarded by post, they must be sealed and prepaid according to the regulations and rates which govern the transmission of ordinary letters. Any package sent by Book or Sample Post is liable to be opened for examination by the officials of the Post Office.

Let the backing cards be removed from between the exposed films, as suggested in the former section, and let the pack be securely protected from light, in opaque

wrappers, as above directed. It is advisable to still further protect the parcel by enclosing it in a light pasteboard box, such as that in which the fresh films are sent out by the makers; this additional casing will prevent injury of the sensitive surfaces by the blow of the date stamps to which postal packages are subjected. Pressure marks, invisible to the eye, will often become apparent on development.

When films have been developed and dried they may be sent by post in much simpler packages, and at cheaper rates. Four or five Frena negatives, which may be exposed to light without being injured, can be enclosed in an ordinary one-sheet letter without increasing the penny postage. Larger parcels of film negatives can be sent to foreign countries within the Postal Union by book-post, at fourpence per pound, that is to say, at the rate of one penny for fifty or more films.

It is important that film negatives should be varnished, before being sent about from place to place. They are thereby not only protected from injury by abrasion, but are rendered less susceptible to the deleterious effects of dampness, to which they will always be more or less exposed, in mail bags, and in the hands of postmen on rainy days.

Charles Lamb tells of a certain young man, who wanted to be a tailor, but had not the

spirit. For those who have not the spirit to improvise a dark room, wherein they can themselves remove the exposed films, and recharge the holder, it will be found a safe, albeit a somewhat inconvenient plan, to send the entire Frena, unopened, to us, at the address given on the title page of this book. The apparatus will be returned immediately, recharged and ready for a further series of exposures. At the same time the exposed films will be removed and developed. Prints of the pictures taken can be supplied thereafter in any desired number.

Those who desire to adopt this simplest conceivable system of picture making, will find that the Frena travels safely by Parcel Post. Let the camera be packed in a strong cardboard or light wooden box of suitable size, with a stuffing of crumpled paper or other soft material at the sides, so that it does not shake about. Around the box secure one thickness of stout paper, upon which the address should be written. Parcel Post charges must be prepaid. Do not omit to write distinctly upon the outside of the package the name and address of the sender, as this serves as the means of identification. Then inform us by letter, in the same mail, how many prints of each picture are desired.

## Appendix A.

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### DEVELOPMENT.

WHEN a sensitized photographic film is exposed in a camera, a latent chemical image, invisible to the eye, is imprinted upon its surface by the flash of light which is admitted through the lens during the revolution of the shutter. In order to transform this latent image into a visible negative representation of the scene depicted, the exposed film must be subjected to the action of certain chemicals.

Black metallic silver is thereby precipitated in those parts of the bromide of silver emulsion which have been acted upon by light. This process is termed *development*. When it has been carried sufficiently far, all the bromide of silver which has not been affected by light, or has not been precipitated by the developing chemicals, must be dissolved out of the film by placing this in a solution of hyposulphite of soda (commonly spoken of as "hypo"). This secondary process is termed *fixing*.



The image which is thus obtained is called a *negative*, because it is the reverse of the natural scene in respect to light and shade : the sky, for instance, being dense and black, whilst the dark fence outlined against it is light-coloured and transparent. By again reversing this negative image, through the process of printing upon sensitized paper, a photographic *positive* may be obtained, the lights and shades of which are like those of the natural scene.

It is by no means necessary to develop a film as soon as the exposure has been made upon it. So long as the sensitized surface is effectually protected from the further action of light it will retain, without alteration, the latent image impressed upon it. Its development may hence be deferred, as is often desirable in the case of an extended journey, for weeks, or even years.

All the operations of development must be conducted in a photographic dark room, from which every trace of actinic light has been excluded. The nature of such a dark room has been already set forth in describing the precautions which are to be observed in

removing exposed films from the Frena; compare Section 12.

Let the effectiveness of this exclusion be tested by the operator remaining for several minutes in his dark room, with the red window closed, and without a red lamp. The eye will then, through the enlargement of the pupil, be enabled to detect any ray of the outer illumination which may leak in through crevices previously overlooked.

It is furthermore important that the light of the dark room should be sufficiently subdued, and of a sufficiently deep ruby colour.

If the operator finds that his films are liable, when placed in the developer, to darken all over in a way otherwise inexplicable, he should test the non-actinic quality of his dark room illumination by exposing to the direct rays of his ruby window, or lamp, a fresh film, one portion of which is marked by a strip of black paper, or by a coin laid upon it. The film should be thus exposed within 2 feet of the window or lamp for about a minute. Then let it be developed in the usual manner. If a light-coloured image of the paper strip or of the coin becomes apparent upon the sensitive surface, it will be evident that the red light admitted to the dark room should be either rendered of a deeper tint, or decreased in quantity.

Although any well enclosed space may suffice for changing the films and recharging

the Frena, it will be found inconvenient to fix and wash a large batch of negatives in a room not provided with a water-tap and sink. Many kitchens and bathrooms are nocturnally appropriated by amateur photographers who have these advantages in view. In default of running water, let a large jug and slop pail be provided; and let it be borne in mind that the colder the water used for development the better. Warm water will tend to soften and frill any gelatine film.

Every formula for development which gives good results with glass plates is equally applicable to films. Hence the photographer may, if he prefer, follow the instructions for development with iron, pyrogallol, hydroquinone, eikonogen, amidol, &c., which are to be found in the various text books of photography cited in the introduction (page 6), and also in compendious form, in the excellent annuals and year books of the English photographic journals.

Let the beginner, however, thoroughly master one method of development before experimenting with others. Good results are obtainable with every one of the formulæ in general use, and the beginner must not lay the flattering unction to his soul that his failures to produce good negatives may perchance be due to this or that particular chemical which he has selected.

The developer which we would recommend to the beginner, as providing the simplest method of negative making, is that which employs a single concentrated solution of a new and complex chemical, prepared, ready for use, under the name Rodinal. Ten or twelve drops of Rodinal will, without other additions, transform an ounce of water into an efficient developing bath. It will suffice for our present purpose to give directions for developing by this method alone.

The apparatus for development should consist of :—

Dark room lamp.

Trays for development, rinsing, hardening and fixing.

Washing rack and tank.

Measuring glass, 2 oz.

Dropping bottle, 1 oz., for Rodinal.

The following chemicals will be required:—

One small bottle of Rodinal.

Common Alum, in powder, say 2 oz.

Hyposulphite of Soda, in crystals, say 1lb.

Care should always be taken to insure the cleanliness, in a chemical sense, of all dishes used for development. Some amateurs have been known to use one and the same tray successively, for developing, rinsing, hardening and fixing their films,—and even for the toning of their prints. A large proportion of spotty and foggy negatives will be the inevitable result of such methods. It is recommended that a separate tray should be devoted to each purpose, and that the vessels used for development and toning should be thoroughly washed after each operation.

### DEVELOPMENT.

Arrange the trays in the order in which they are to be used. Take the film to be developed, being careful not to touch the sensitive surface with damp fingers (compare page 114),—and lay it, dull gelatine side uppermost, in a clean developing tray. Pour over the film enough plain water, say two or three ounces, to entirely submerge it. Let it soak therein for half a minute or more, shielding the film from the light of the dark room window, or ruby lamp, by covering the tray with a piece of stiff paper or pasteboard. Then pour all the water off, into a washing tray, and flood the film with the developing

solution. This may be prepared whilst the film is soaking, by mixing—

**1 part of Rodinal with 40 parts of water.**

This is in the proportion of twelve drops of Rodinal to each ounce of water. Make a sufficient quantity of developer to completely submerge the film; one ounce and a half will suffice if the small trays supplied for the Frena film No. 2 (quarter-plate size) are used. If any portion of the film should project above the solution, the development would be uneven and the negative spoiled. In about a minute the high lights of the picture, such as the sky in a landscape, or the face in a portrait, should begin to make their appearance, as dark patches upon the white surface of the film. The development having thus commenced, the tray should be covered again with a sheet of stiff paper or pasteboard, and the film should be allowed to remain submerged in the developing solution for at least five minutes longer. At the end of that time examine the density of the black patches by transmitted light, holding the negative between the eye and the dark room window or

lamp. As the gelatine coating is exceedingly tender when wet, and is hence very liable to be scratched by the finger nails, this is an operation which must be performed with the utmost precaution. The film should be held only by its edges, and be lifted from the bottom of the tray, if necessary, by carefully inserting the point of a pin beneath it.

Developing dishes of transparent material, such as those which are supplied with the Frena outfit, greatly facilitate this inspection. They are provided at one end with a well for holding the developing solution, while the entire tray, with the film lying in it untouched, is held up in front of the window or lamp.

Let not the operator be in too great a haste to take the film out of the developer and hold it up to the light for examination. Let it remain in the tray untouched until the shadows of the picture, that is to say the cream-coloured patches of the negative, grow darker and darker; until, in fact, these patches are scarcely distinguishable in tint from those parts which darkened first.

When the darkest portions of the negative appear, by transmitted light, to be absolutely

black and opaque, and when the main features of the picture can be distinctly seen upon the back of the film, the process of development may be considered to have been carried far enough. It will generally be found that when using the Rodinal solution the process of developing a normally exposed film has occupied fully ten minutes or a quarter of an hour.

The exact moment when development should be stopped is always difficult to determine. Fortunately there is considerable latitude, as it is only in extreme cases of underdevelopment that it will prove quite impossible to obtain a print of some kind from the negative.

It may be observed, in this connection, that the density of a landscape negative should be greater than that of a portrait, and the development hence be carried further in the former than in the latter case. The result of overdevelopment in the case of a portrait is that the high lights are clogged, and, giving hard and chalky prints, lose all the finer gradations of flesh modelling.

The point at which the process of development should be suspended thus varies greatly with different exposures, being largely dependent upon the character



of the subject. Objects which naturally present but little contrast of light and shade should, as a general rule, receive a comparatively short exposure and a protracted development. On the other hand, subjects with brilliant high lights and very dark shadows should have these contrasts reduced by a comparatively long exposure and a rapid development. An accurate judgment in these matters can only be obtained by experience and close observation of the effects produced in the finished picture.

As a guide to the beginner we may briefly characterize the effects of insufficient and of excessive development.

*UNDERDEVELOPMENT* results in very thin and weak negatives, the highest lights of which are not sufficiently opaque to prevent, during the subsequent process of printing, the sensitized paper from darkening beneath them.

If the exposure of the film in the camera has been of just about the right duration, and the negative underdeveloped, many of the details in the shadows of the finished picture will be altogether lacking. If, on the other hand, the exposure in the camera has been somewhat too long, and the negative underdeveloped, all the details of the picture will be visible, but lacking in contrast. In the latter case the defect may be

remedied, in some degree, by submitting the negative to the after process of *intensification*, full directions for which are given in all photographic text books.

*OVERDEVELOPMENT* results in excessively black and opaque negatives, which may require days to print.

If the exposure of the film in the camera has been somewhat too short, and the negative overdeveloped, the details will be lacking from the high lights of the finished picture, and the print will be harsh and staring. If the exposure in the camera has been approximately correct, the printing quality of the negative may be greatly improved by submitting it to the after process of *reduction*, directions for which will be found in the text books.

It may be remarked that beginners are much more prone to underdevelop than to overdevelop their negatives, and it is well to bear in mind that, of the two extremes, underdevelopment is by far the worse.

The same developing solution may be used for two or three films in succession. Its action will, however, gradually become slower and less vigorous, and it is not advisable to carry this economy too far. The value of the chemicals employed is insignificant, an ounce of fresh Rodinal developing bath, sufficient for

several quarter plate films, can be made up at a cost of but one-eighth of a penny.

Let the Frenographer be warned against developing several films in one tray at the same time. This is a popular time-saving device, but it is attended with grave dangers, not only on account of the greatly increased liability of the delicate gelatine surfaces to be injured during the inspection of the films, but also, and more particularly, on account of the tendency of the films to float together and adhere in the liquid, and to develop unevenly in consequence.

#### RINSING.

When development is complete, the film should be placed in another tray and washed by pouring clean water over it, so that all traces of the developing solution are removed from its surface. When this has been done, the film may be exposed to daylight without harm.

#### FIXING.

The film should then be transferred to the fixing bath. This should be made up in advance, as a stock solution, and should consist of

**One part of Hyposulphite of Soda,  
dissolved in five parts of water.**

Or in other words, one cupful of hypo crystals to five cupfuls of water. This solution will keep any length of time.

Take enough of it, in a good-sized tray, to completely submerge the negative, which must be left therein for some minutes after every trace of the white colour has disappeared from the back of the film. No harm will be done by allowing the negative to remain in the fixing solution for ten minutes or a quarter of an hour.

Always make the fixing bath of uniform strength. One pound of hypo will make just half a gallon of stock solution. Do not add alum, or any other chemical, to the hypo bath. Do not use the bath after it has become charged with silver through fixing many films, and has become discoloured, or begins to work slowly. Hypo is cheap, and such economy is short sighted, as it may risk the permanency of many a valuable negative.

#### HARDENING.

When, as is liable to occur in warm weather, the gelatine coating of the film shows a tendency to frill or blister during the process of development, it should, after fixing, be placed for two or three minutes in a saturated solution of common alum.

This hardening bath may be used repeatedly, until it becomes discoloured. It may be easily prepared by putting an ounce or two of powdered alum in a half-pint bottle, filling up with water, and shaking. The undissolved alum which settles at the bottom of the bottle need not be disturbed in pouring out the dose.

### WASHING.

When the batch of films developed at one operation have been thoroughly fixed and rinsed, they must be placed in a large vessel and washed for two or three hours, in running water, or in frequent changes.

It is recommended that the film should be held, during the process of washing, in the rack and tank supplied for this purpose.

When a number of films are allowed to swim about in one vessel, especially when they have not been previously subjected to the hardening action of an alum bath, there will be much danger of the tender gelatine surface becoming scratched and abraded. Upon this point Colonel Waterhouse, Surveyor-General of India, has remarked, "I find that these films require more careful treatment than one is disposed to give them, in view of their being so much more easily handled than glass, and not so liable to break. No one would think of washing a lot of dry

plates on glass together in a tub, though it seems natural and harmless enough to do so with these light films, which are more like prints than negatives. The tender gelatine coating of the films is, however, just as liable to be injured by the sharp corners of the celluloid, as it would be by glass. The films ought, therefore, to be washed separately and with quite as much care as glass plates."—*Year Book of Photography*, 1892.

This is, perhaps, an extreme view. The danger of injuring the gelatine surface will be greatly diminished if the alum bath is used immediately after fixing. When the surface has been thus hardened, and when the stream of water flowing into the washing vessel is not so rapid as to cause a great commotion amongst the films, no bad results will be likely to ensue. All danger, will, however, be obviated by the use of the washing rack.

The permanency of the negative will depend in large measure upon the thoroughness of this process of washing. Any vestiges of hypo permitted to remain in the film will tend to discolour and to destroy the silver image.

#### DRYING.

When the films have been sufficiently washed they should be removed from the water and allowed to drain and to dry spontaneously.

They should be placed, gelatine side uppermost, upon some flat and inclined support,—preferably upon the drying-board, supplied for this purpose. The gelatine surface must on no account be permitted to come into contact with the support. Let the operator assure himself most carefully that the films are laid upon their smoother and more shiny celluloid side.

Permit the films to remain undisturbed until they are perfectly dry. Artificial heat must never be employed to accelerate the process of drying; placing the films near the fire would be very likely to melt or crack the gelatine and destroy the image.

## Appendix B.

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### **DEVELOPMENT AS A CRITERION OF EXPOSURE.**

IT is a fascinating magic, and an ever-recurring delight, this gradual appearance of the negative image upon the blank white surface of the film. But entirely apart from the charm of the operation, the process of development has an instructive value which must not be overlooked. The Frenographer will find that one of the greatest advantages of developing his own negatives will be the possibility of obtaining thereby a trustworthy guidance in respect to the duration of his exposures.

When an amateur receives a batch of finished negatives which have been developed for him by some professional photographer he may, indeed, be told why it is that so and so many of the exposures would not make satisfactory pictures. But knowledge obtained by this royal road does not tend to impress



itself upon the mind. Many of the original shortcomings will, moreover, have been concealed by the innumerable devices of the craftsman, and will thus altogether fail to convey a lesson to their author. Hence the development of every picture, ought, if possible, to be undertaken by the person who has made the exposure.

The indications which may be derived from an attentive observation of the behaviour of the film in the developing solution will conclusively prove whether, in setting the speed of his shutter, the operator has come within the limits of correct exposure, or, if he has erred, whether this has been upon the side of under or overexposure.

When the amount of light admitted through the lens to the sensitive surface has been sufficient, yet not excessive, the dark patches which form the negative image will appear rather slowly, and in a regular gradation: the high lights of the picture first, the details in the shadows last. If, on the other hand, the entire film, though not fogged through extraneous light, rapidly darkens all over when placed in the developer, this may be taken as an evidence that the exposure has been too long. If the high lights alone appear, and continue to become very black and opaque before the details are visible in the deepest shadows, this will be a proof that the exposure has been too short.

In the case of every film, the Frenographer should endeavour to recall to his mind the conditions under which the exposure was made,—chiefly reverting to the actinic efficiency of the light at the time (compare page 55), but not omitting to take into consideration the colours of the natural objects (page 56), and their position in relation to the sun (page 57). It is thus alone that a trustworthy judgment can be acquired in regard to the requisite length of photographic exposures.

The extremes of error may be thus briefly characterized.

#### *OVEREXPOSURE.*

The negative “flashes out,” that is to say, darkens all over soon after being placed in the developer. The gradation of tone in the image is insufficient; the contours undefined. In short there is a general lack of contrast. If the development be suspended before the shadows of the finished picture are clogged through the undue precipitation of silver upon them, the high lights will be found to remain too feeble and transparent. A print made from an overexposed negative will be wanting in brilliancy, and, in a certain sense, in definition.

The operator who has become somewhat experienced in photographic manipulation will find that overexposure may be in a measure counteracted during development by the addition of a small quantity of Bromide of Potassium to the developing solution. Let an ounce or so of this restrainer be made up in a dropping bottle, the proportions being one part of Bromide of Potassium to 10 parts of water. This will keep, and may be regarded as a stock solution.

When the behaviour of a film in the normal developer indicates overexposure, let 4 to 8 drops of the restrainer be added as soon as possible to each ounce of the developing solution. The development may then be carried somewhat further as regards density of the image than is ordinarily necessary.

When the contrasts of colour are naturally weak in the subject depicted, as will be the case with architectural details photographed under a dull sky, or with certain landscapes, a small quantity of the restrainer may be advantageously added to the developer, even when the exposure has been of normal duration.

When Bromide of Potassium has been added to a developer this bath should, of course, not be employed for the development of another film, unless this is known to be likewise overexposed.

### *UNDEREXPOSURE.*

When the film is placed in the developing bath, the high lights of the picture will appear

rather slowly, and will continue to acquire density, while the shadows remain a blank. An underexposed and fully developed negative will give a *heurté* print, with inky shadows and hard and staring high lights.

There is no effective remedy for underexposure. Where the light has had no chemical action, the developer labours in vain to precipitate a silver image. To increase the proportion of Rodinal in the developing solution would only tend to heighten the contrasts in the negative. The course which will produce the best results possible under such untoward conditions, is to dilute the customary developer with an equal quantity of water. In this weak bath the negative may develop slowly for an hour or more.

The operator should bear in mind that Rodinal differs from all other chemicals used for development, inasmuch as it requires to be diluted, rather than strengthened, for cases of underexposure.

## Appendix C.

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### PRINTING ON CHLORIDE PAPER.

THE processes of photographic printing are many, and the results which may thereby be obtained differ greatly in appearance. Yet all these processes are based upon one and the same principle: that of exposing to light, beneath the finished negative, a surface which has been rendered sensitive to actinic rays. Those portions of the negative which are more or less dark coloured, more or less shield the sensitive surface from the chemical action of these rays during the operation of printing, and thus form the lights and half tones of the finished picture. The deepest shadows correspond to the most transparent parts of the film. In this way the *negative* image, in reversed chiaroscuro, serves to engender a *positive*, the lights and shades of which are the same as those of the scene photographed.

The method of printing, which we are about to describe, is technically known as the Gelatino-Chloride of Silver process. It has the advantage of producing results superior both in beauty and in permanence to those of the Albuminate of Silver process (which it is rapidly supplanting). Moreover it is, with the sole exception of the inferior blue-print, or Ferro-Prussiate process, the simplest of all methods of positive making.

Gelatino-Chloride paper is prepared by various manufacturers, and is put upon the market under various trade names. It is supplied ready for use, and has comparatively good keeping qualities.

The image formed upon it is visible during the process of printing, and it is thus possible, by examining the positive from time to time, to suspend the operation when the desired depth of tone has been obtained. The after processes of toning and fixing may be performed in one bath, in broad daylight and without preliminary washing. The surface of the finished prints may be rendered either matt, or highly glazed.

### PRINTING.

The requisites herefor are: the sensitized paper, one or more printing frames, and, if it be intended to make prints having white margins, a selection of paper masks.

The sensitized paper may be purchased either in large sheets, which may be cut up with scissors as

required, or in packages of separate leaves, ready cut to quarter plate size.

The chloride of silver coating of the printing paper is far less sensitive to light than is the bromide of silver emulsion of the films, and hence does not imperatively require the protection of a photographic dark room. The sensitized sheets should not, however, be exposed, during the process of cutting up, or of filling the frames, to the strong daylight which is required for printing. It is advisable to expeditiously unpack and manipulate the paper in the dark corners of an ordinary room, or behind a screen or curtain. The degree in which such exposure to light is permissible can readily be gauged. The sensitized surface must never be allowed to darken to a perceptible extent before being placed in contact with the negative, inasmuch as such discoloration would impair the brilliancy of the high lights in the finished picture.

Packages of gelatino-chloride paper should be efficiently protected from dampness, the effects of which are detrimental to the keeping qualities of all sensitized photographic materials.

The printing frame is a holder containing a sheet of glass, against which the negative and the sheet of sensitized paper are pressed in close contact by means of a spring pressure-board. This pressure-board is so hinged as to permit of the print being examined,

during exposure, without disturbing the relative positions of film and paper.

Masks are sheets of opaque paper, somewhat larger than the print, having central apertures of various sizes and shapes, through which the desired portions of the negative can be printed. The margins of a print thus masked, being protected by the opaque paper, remain white.

The process of printing is extremely simple. Remove the spring pressure-board from the glass of the printing frame, place the negative, shiny celluloid side downwards, upon the glass. On the face of the negative lay a sheet of sensitized paper, with its glossy side towards the film. If a print with white margins be desired, insert a mask having an aperture of suitable size between the negative and the sensitized paper. Replace and fasten the spring pressure-board, so as to hold the sheets in close contact.

The printing frame, with its contents, must then be exposed, glass uppermost, to bright daylight.

It may be observed that the stronger the light in which the process of printing is carried out, the less marked will the contrasts become in the finished picture. If



the negative is very dense and black, with strongly pronounced contrasts of light and shade, it may be advantageously printed in direct sunlight. If, on the other hand, the negative is thin and delicate, it should be printed slowly, at some distance from the window. The influence of the light in thus affecting the contrasts of the negative is, however, not very marked; it can never make up for the defects of extreme under or overdevelopment.

The length of time required for printing varies enormously, in accordance with the actinic efficiency of the light, and, more particularly, with the density of the negative. A somewhat underdeveloped film, with clear shadows, may be sufficiently printed, on a bright day, in five or ten minutes; while a much overexposed and overdeveloped negative may require to be placed in the direct sunlight for days together. The photographer will do well to make a rough estimate of the density of the film from which he is about to print, and to examine the progress of the operation some little while before he thinks it probable that the sensitized paper will have become sufficiently dark.

This examination may be made, in subdued

light, by folding back the hinged pressure-board of the printing frame, and lifting up the sensitized paper from the film, care being taken that the relative positions of the negative and the print are not altered. If the print be not sufficiently dark, the pressure-board can be again folded down upon it, and the exposure continued.

Let the inspection be as rapid as will permit an accurate judgment of the depth of tone which has been acquired. Do not be tempted to gaze at the print for the sake of its pictorial interest. The longer the frame remains open the greater the liability of the whites of the picture to be degraded through extraneous light. And the oftener the frame is opened the greater the danger of the paper being shifted upon the film, and the image thus becoming blurred.

Before being taken from the frame, the print must be allowed to become somewhat darker than the finished picture is to appear, inasmuch as the process of fixing appreciably diminishes its depth of tone.

It is difficult to describe the exact degree of excess which has thus to be allowed for, but it may be roughly estimated to be equivalent to 15 per cent. of

the total exposure. In other words, if the sensitized paper is found, on examination, to have acquired, after an exposure of say one hour, just that degree of depth which is desired in the finished picture, the print should be permitted to remain in the frame, under identical conditions of light, for another ten minutes or so. A little experience will soon give the operator an instinctive judgment in respect to the depth of tone which is thus required as an excess.

When the picture is sufficiently dark, the pressure-board should be removed from the glass and the print taken out of the frame. It may then be at once subjected to the action of a chemical bath, which prevents further darkening of the image by removing the chloride of silver not affected by light, and at the same time changes its unsightly brick-red colour to an agreeable dark chestnut.

It is not necessary to fix and tone the sheets of sensitized paper as soon as they are printed. If put away in a light-tight box, or wrapped in several thicknesses of brown paper, the prints will remain unaltered for several days, and can be toned at convenience.

### FIXING AND TONING.

We recommend the beginner to make use of a "*combined*" fixing and toning bath.

The advantages of this are that the prints do not require a preliminary washing, and can hence be fixed and toned, one by one, in broad daylight, as soon as they are taken from the printing frame. A "combined" fixing and toning bath is the simplest and most expeditious means of performing these operations, and its results are fully equal to those obtainable by the more complicated methods. The formula which we give is substantially identical with that published by the Eastman Company in connection with their "Solio" Gelatino-Chloride paper.

Make up the following two stock solutions, which will keep, separately, any length of time.

#### STOCK SOLUTION No. 1.

Hypo-sulphite of Soda	...	1 pound.
Common Alum (Potash Alum, not Soda Alum)	...	3 ounces.
Sulphate of Soda (Glauber's Salt)	... ..	9 ounces.
Water	... ..	5 pints.

The slight turbidity of the solution will not interfere with the action of the toning bath; still it is well to let this stock solution stand for two or three hours before using.

## STOCK SOLUTION No. 2.

Chloride of Gold ...	...	15 grains.
Acetate of Lead (Sugar of		
Lead) ...	...	64 grains.
Water ...	...	8 ounces.

Chloride of gold is sold in hermetically sealed glass tubes, each containing exactly 15 grains. Place one of these tubes in a half-pint bottle, and break it by a blow with a stirring rod. There will thus be no chance of waste. A heavy precipitate will settle in this stock solution, which must be well shaken up before being added to the toning bath.

To make the TONING BATH, take of:

Stock Solution, No. 1	...	5 ounces.
Stock Solution, No. 2	...	$\frac{1}{2}$ ounce.

The precipitate in the solution No. 2 will be completely dissolved on being poured into the stock solution No. 1. The quantity given will efficiently tone 25 or 30 prints of the size of those required for the pictures made with the Frena No. 2. It is, however, not advisable to let the bath stand more than a day or two after having been mixed, as an old toning bath has a tendency to give yellowish tints to the half tones of the print.

Entirely submerge the print in the solution thus prepared, taking care, if several pictures be toned at once, that they do not adhere to each other, as uneven toning would result. The process of fixing will be rapid, the print losing its excessive depth of tone almost immediately, and becoming of a lighter brick red. Permit the print to remain in the bath until this colour has become altered to the tone desired.

The change of tint will take place in the following sequence: Light brick red, reddish chestnut, chestnut brown, grayish brown, yellowish black. It is not advisable to continue the toning process after a rich dark chestnut colour has been obtained. The grayish brown and yellowish black tints are not pleasing, as they give to the print a sallow and faded appearance. The length of time required for toning will be about five or ten minutes, according to the darkness of the prints, and the freshness and temperature of the toning bath. Prints tone more rapidly in warm than in cold weather, but cool toning baths work more evenly.

This "combined" Toning Bath has one notable drawback: in order to give good results it must be used at a comparatively

low temperature. A combined bath warmer than, say, 45 or 50° Fahrenheit will give displeasing yellowish-green tints to the half tones of the print, especially when the mixed bath has been allowed to stand for some little time. In the summer season, and in tropical climates, if ice is not at hand for the purpose of artificially cooling the bath, it will hence be found advisable to follow one of the formulæ for *separate* Toning and Fixing Baths, which will be found in the circulars of the various manufacturers of Gelatino-Chloride Paper. Of these separate baths given we are inclined to prefer, as regards the artistic quality of the results, the Platinum Toning formula, which gives a fine sepia brown tone to the prints.

### WASHING.

When the print has been sufficiently toned it should be removed from the toning bath and washed for 2 or 3 hours in a large vessel of clean water:—under a tap, if possible; if

not, in frequent changes. The permanence of the print will depend almost entirely upon the thoroughness of this washing.

Various forms of print washing tanks have been devised, and undoubtedly do much towards expediting the process. The most essential requirements of such apparatus are that the prints should be kept in constant motion by the stream of inflowing water, and that the outflow should be taken from the bottom of the vessel, so as to carry away all traces of the chemicals which are washed out from the prints. A prolonged soaking is far less effective than a comparatively short rinsing in flowing water.

### DRYING.

After the print has been thoroughly washed it should be carefully taken out of the water, and laid face upwards upon any plain surface to dry spontaneously. On no account should the print be dried between blotting papers, as the gelatine side would adhere thereto.

If a highly glazed surface be desired, the print may, on being taken from the washing water, be placed face downwards on a polished slab provided for this purpose, and gently pressed into close contact by



means of a rubber squeegee. No air bubbles should remain between the face of the print and the slab. In the place of the slab a sheet of plate-glass or a ferrotype plate may be used, provided the surfaces of these substitutes be rubbed, before the wet print is laid upon them, with a solution consisting of a piece of spermaceti about as large as a hazelnut dissolved in a 4 ounce bottle of benzine. Exact proportions are not essential. If the glass or ferrotype plate has been touched with a few drops of this solution, and gently polished with a soft cloth, the print may, when perfectly dry, be readily stripped therefrom.

If a matt surface be desired, a piece of ground glass, sparingly treated with the spermaceti solution as described, should be substituted for the polished plate.

The print must not be stripped from either of these supports until it has become thoroughly dry.

### MOUNTING.

Gelatino-chloride prints which have not been glazed may be mounted with pure paste or mucilage in the usual manner.

In the case of enamelled or matt surface prints, special precautions are requisite in order to preserve the surface in its full perfection. The mount should have a preliminary coating of tragacanth or dextrine mucilage, and be permitted to become dry. Meanwhile the back of the print, when nearly dry, and

before being stripped from the support, should be brushed over with very thin pure glue, well filtered. When the print with its backing of glue has become thoroughly dry, it should be removed from its support and placed upon the mount which has been moistened by passing a damp sponge over it. This is rather a troublesome process, and it may be questioned whether it is worth while to enamel those prints which are to be mounted.

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FIG. 37.

REDUCED FACSIMILE OF LABEL FOR QUARTER-PLATE  
FRENA FILMS.



## Frena No. 2 Price List.

---

<b>The Frena No. 2</b>		£	s.	d.
<b>Quarter-Plate Size—</b>				
Complete with 40 films ready for use		8	17	6
<b>Frena Magnifiers No. 2—</b>				
Set of 4 in Case	.. .. .	0	10	6
Orthochromatic Screen	.. .. .	0	3	6
Black Leather Case to carry Frena No. 2, with Sling Strap 15/-, lined with Velvet		0	17	6
Brown Leather Case, lined with Cream Velvet	.. .. .	1	5	0
Waterproof Canvas Case to carry Frena No. 2, with Sling Strap..	.. .. .	0	8	6
Bicycle Carrier to carry Frena, in Case, on Handle Bar	.. .. .	0	5	0
Fourfold Tripod, specially light for Cyclists		0	19	0
„ „ with Sliding Legs	.. .. .	1	1	0
Threefold Tripod	.. .. .	0	15	0
Brass Telescopic Tripod, specially light, shutting up to 14½ in. length	.. .. .	1	5	0
Light Bamboo Tripod, with Telescoping Legs	.. .. .	0	12	6
Walking Stick Tripod	.. .. .	1	4	0

M

**Frena Films—**

Per pack of 20 .. .. 3/7 to 0 4 6

According to make. See special list.

(Postage in the United Kingdom, single pack, 3d.)

Developing 20 films .. .. 0 5 0

Printing and mounting 20 prints .. .. 0 5 0

Printing 20 prints unmounted .. .. 0 4 0

Envelopes for sending Frena negatives  
by post, in sets of 3, per doz. sets .. 0 1 6

Enlargements from Frena negative, mounted  
on rough card .. .. from 0 3 0

Price according to size. See special list.

For Framing, see special list.

Lantern slides, made from Frena nega-  
tives .. .. each 0 1 3

Book for storing Frena negatives to hold  
50 single or 100 back to back .. .. 0 1 0

**Albums for Frena Prints—**

Album to hold 2 on page, 40 pages stiff  
card .. .. 2/6 & 0 4 6

Album to hold 4 on page, 60 pages stiff  
card .. .. 5/0 & 0 7 6

Album for unmounted prints, to hold 200,  
4 on a page .. .. 6/6 & 0 17 6

Album for unmounted prints, to hold 100,  
2 on a page .. .. 4/6 & 0 9 0

Album for unmounted prints, to hold 48  
1/6 & 0 5 6

Album for unmounted prints, to hold 24  
1/0 & 0 3 6

Album for unmounted prints, to hold 12 0 1 6

**Developing and Printing Apparatus.****Developing and Printing Set—**

Complete Developing Set comprising the requisite apparatus, and sufficient materials for making about 500 negatives as follows :—

Dark Room Lamp.

1 Large Porcelain Dish.

2 Small „ „

3 „ Xylonite Dishes.

Washing Rack and Tank.

3 Glass Measures.

Dropping Bottle with Potassium Bromide.

1 Large Bottle Rodinal.

1 Camel Hair Brush.

6 Developing Clips.

12 Drying Clips.

Supply of Alum and Hypo in Crystals.

2 Printing Frames.

1 packet Printing Paper.

1 box Masks.

3 doz. Mounts.

Toning and Fixing Solution.

In Cabinet .. .. £4 4 0

**Developing and Printing Sets,**

without cases .. .. £1 10 0 & 2 15 0

**Developing Set—**

Compact Developing Set for travelling, containing sufficient materials for developing about 100 negatives as follows :—

£ s. d.

Dark Room Lamp.  
1 Small Porcelain Dish.  
3 Xylonite Dishes.  
Washing Rack and Tank.  
2 Glass Measures.  
1 Dropping Bottle.  
Bottle of Rodinal.  
Supply of Hypo and Alum in Crystals.  
Drying Clips.

In Cabinet .. .. 1 10 0

**Developing Sets, without cases,**

£0 10 6 £1 0 0 & 1 10 0

Small Travelling Set of Developing Chemicals  
and Trays, in box, 7/6

**Developing Apparatus—**

TRAYS. Xylonite, transparent, with retaining flap for developing	0	1	3
„ Xylonite, opaque, for hardening, rinsing, &c...	0	0	7
„ Porcelain, for developing or hardening .. ..	0	0	6
„ Glass do. do. ..	0	0	8
Porcelain, large, for fixing, toning or washing .. ..	0	1	7
Rack and tank for washing negatives	4/0	0	7 6
Drying-board .. ..	0	5	0

**Developing Apparatus—Continued.** £ s. d.

Drying-board; folding .. .. .	0	7	6
Spare clips for drying negatives, per doz.	0	0	6
Developing Clips to hold film while developing .. .. . per doz.	0	2	0
Glass measures, 10 oz. capacity ..	0	1	6
"    4 oz.    "    ..    ..	0	1	0
"    2 oz.    "    ..    ..	0	0	8
"    1 oz.    "    ..    ..	0	0	7
"    1 dram  "    ..    ..	0	0	6
Camel's Hair brushes, flat, 2 in. wide..	0	0	8
Dropping bottle, 1 oz.    ..    ..	0	0	6
Dark Room Lamp .. .. . 4/0 &	0	7	6
"    "    "    large size .. .. .	0	10	6

**Developing Chemicals—**

Rodinal Developer, 3 oz. bottle ..	0	1	6
"    "    1 oz. stoppered bottle	0	0	9
Hyposulphite of Soda .. .. . per lb.	0	0	2
Alum .. .. . "    "    "    "    "    "	0	0	6
Bromide of Potassium .. .. . per oz.	0	0	3

For other Chemicals see special list.

**Printing Apparatus—**

Printing Set, containing the Apparatus and sufficient Chemicals for making 144 Frenographs, as follows :—

6 Printing Frames.			
1 box of Masks.			
3 large Porcelain Dishes.			
Plate for Glazing Prints.			
144 pieces of Printing Paper, cut to size.			
100 Mounts.			
Toning and Fixing Solution,			
ready for use .. .. .	1	0	0

<b>Printing Apparatus—Continued.</b>				£	s.	d.
Bynoe Printing Frame ..	..	..		0	1	0
„ „ „ „ Brass ..	..	..		0	1	6
Masks ..	..	..	per box	0	1	0
Slab for Drying and Glazing Prints ..				0	3	6
Ferro-type Plate for do.	do.	..		0	0	6

**Gelatino Chloride Sensitized Paper—**

Ilford Paper, in sheets, 22 × 17, 2 sheets				0	1	4
„ „ cut to size ..	36	pieces		0	1	0
Kloro Paper ..	..	..	..	0	1	0
Eastman's Solio, cut to size	36	pieces		0	1	0
Paget's, cut to size ..	36	„		0	1	0

**Mounts—**

Plain White or Cream, rounded corners,						
per 100				0	1	6
Coloured, with gilt bevelled edges ..				0	5	0
India Tints, platesunk mounts ..				0	10	0
Cut-out Mounts for unmounted						
prints .. ..			per doz	0	2	0

**Solutions—**

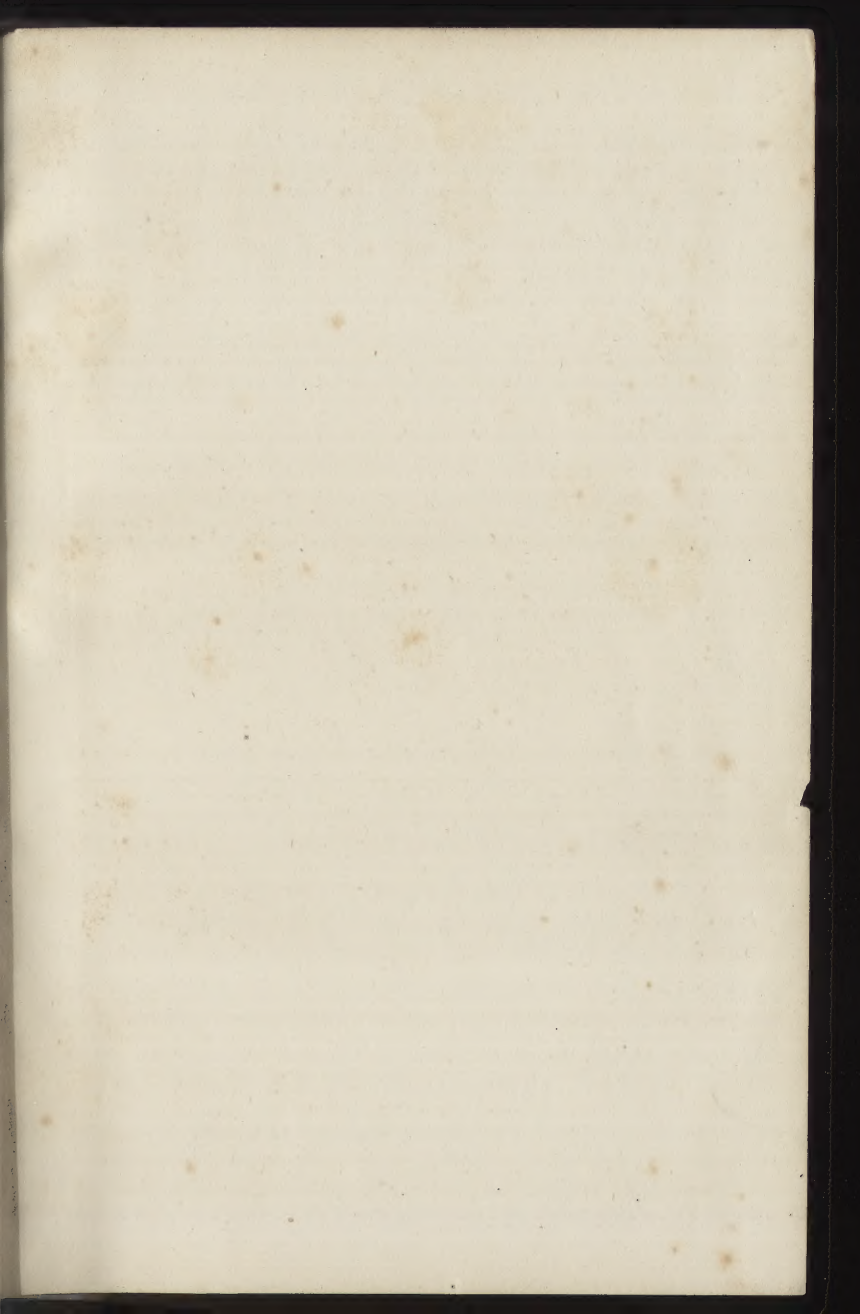
Toning & Fixing Solution, 16 oz. bot. 1/0	}					
Gold Solution .. .. 2 oz. bot. 1/6		0	2	6		
Mounting Solution .. ..				0	1	0

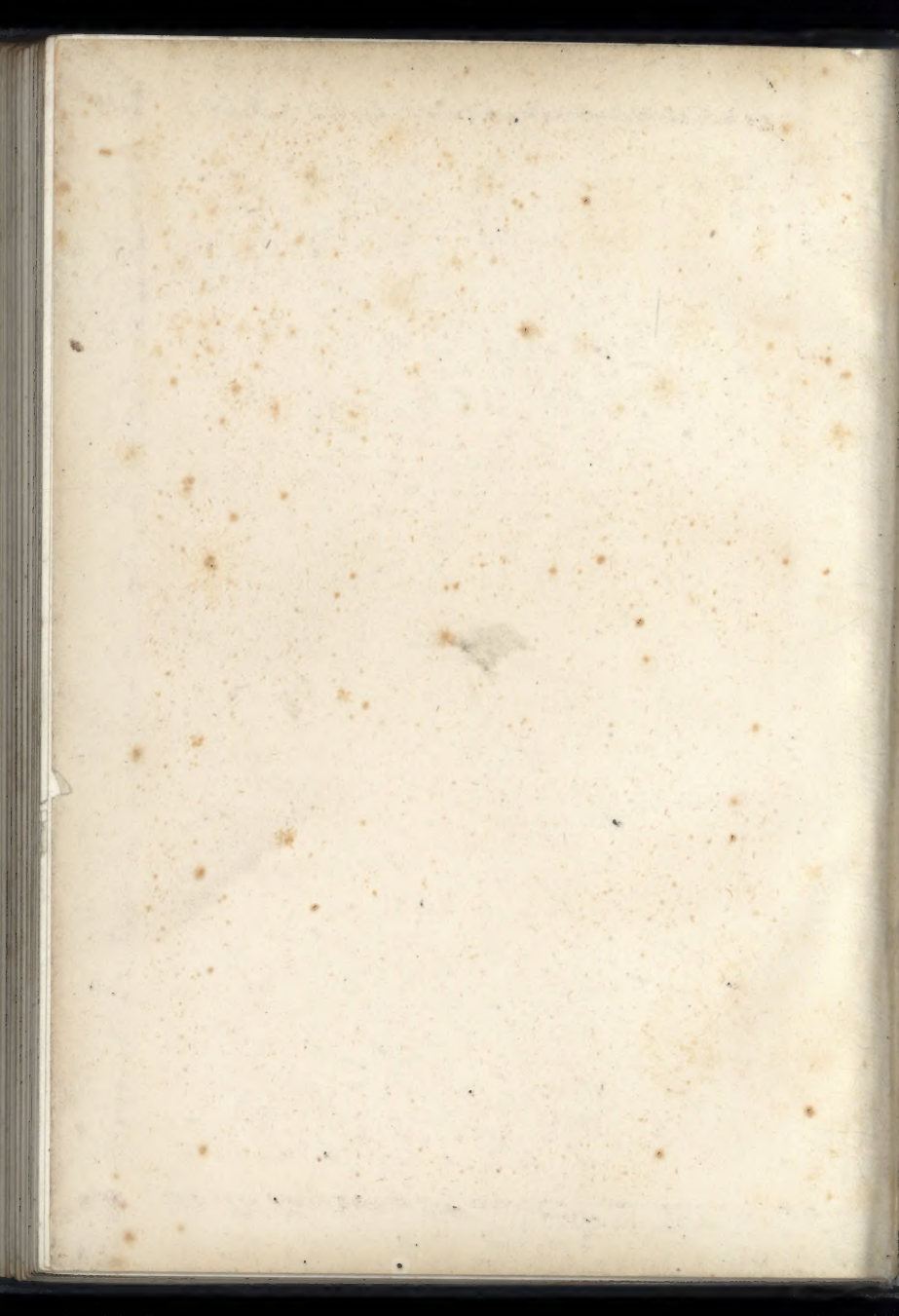
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